

A Critical Analysis of the Clinical Effect and Application of Acupuncture Treatment for Shoulder Pain Disorders in Adults

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Abstract

The study's objective is to evaluate the clinical effect and application of acupuncture treatment for shoulder pain disorders in terms of effectiveness and safety. A narrative review of RCTs in which acupuncture was used as an intervention for patients with shoulder pain disorders (SPD) was conducted. All randomised controlled trials that evaluate the effects of acupuncture for shoulder pain disorders compared with controls were included. The primary outcomes were pain and shoulder function. Based on the inclusive and exclusive criteria, 22 randomised control trials involving 1801 participants that evaluated the effects of acupuncture for various shoulder pain disorders were retrieved from various databases, and the intervention and results were examined. Eleven studies found that acupuncture treatment had significantly greater effects when compared with other therapies or treatments. Nine studies showed that, when combined with other therapies or treatments, the acupuncture group showed a better therapeutic effect than the therapy group itself. The results also show that acupuncture treatment can produce the same therapeutic effects as physical therapy, manual therapy, the uses of tropical NSAIDs, oral medications, and corticosteroid injections. No serious adverse events were observed. The findings indicated that acupuncture could be a safe and effective treatment for shoulder pain disorders by reducing pain and restoring shoulder functions. The results are consistent with those of past literature reviews. Although there is some evidence for the effectiveness and safety of acupuncture for shoulder pain disorders, the level of evidence is still low. Due to several limitations and heterogeneity, the results are inconclusive, and therefore the findings need to be interpreted with caution. Future large-scale studies should be more rigorous and well-designed RCTs with high-quality studies, a longer study duration with more subjects, an ideal standardised treatment regimen, and transparent reporting.

Keywords: *Acupuncture, Shoulder pain, Shoulder disorders, Acupuncture safety, Alternatives therapies, Traditional Chinese medicine, Pain relief.*

Introduction

Pain on the elevation of the arm is a common symptom of various shoulder disorders [1]. Shoulder pain disorder (SPD) is referred to as any level of pain or discomfort in or around the shoulder joint. Since the shoulder joint is one of the most movable joints in the human body, shoulder pain can have a wide range of aetiologies, either from intrinsic disorders of the shoulder or referred pain [2]. Regardless of the

disorder, SPD is one of the most common musculoskeletal and disabling complaints in primary care [3, 4]. It is the third most common musculoskeletal presentation after back and knee pain [5], with an estimated prevalence of 4%–26% in the global population [6]. According to population surveys, shoulder pain affects 18–26% of adults at any point in time [7], making it one of the most common regional pain syndromes. According to reports, the prevalence of shoulder pain in the general population ranges

from 7% to 30%. It increases with age, with women having a higher prevalence than men [8]. The impact of shoulder pain disorders has resulted in a significant socioeconomic burden on society [9-11]. Furthermore, there are significant economic costs associated with rising healthcare demands, subpar job performance, prolonged sick leave, and early retirement or job loss [12].

General treatment for shoulder pain will depend on the cause and severity of the pain. Nonsurgical treatment is effective for most of the shoulder pain aetiologies. Some systematic reviews have reported on various nonsurgical treatments available, such as pharmacotherapy (corticosteroid or hyaluronate injections, glucocorticoid injections, steroid injections, non-steroidal anti-inflammatory drugs [NSAIDs], and oral analgesics), [13, 14]. In many cases, studies reveal that the majority of pharmacotherapy has a wide spectrum of adverse effects. Side effects of oral analgesic medications are a well-documented barrier to successful pain management [15]. Anyway, oral analgesics do not treat disorders but help by changing the way the body senses pain and reducing the pain signals sent by the nervous system and the brain's reaction to those pain signals [16]. The most common side effects are nausea or vomiting, constipation, sedation, cognitive failure, myoclonus, and pruritis [17]. NSAIDs have well-known adverse effects affecting the gastric mucosa, renal system, cardiovascular system, hepatic system, and hematologic system [18]. Hyaluronic acid injections may work better than painkillers for some people with osteoarthritis, but they may be less effective in older adults and people with severe osteoarthritis [19]. In some cases, surgery may be required to correct and restore shoulder pain disorders if nonsurgical options are unable to bring about the desired pain relief or return of shoulder function.

Until today, there has been disagreement inside the medical community over which treatment is the most effective in terms of safety,

pain reduction, and improving shoulder function for SPD. The new guidelines encourage nonpharmacological therapies as the first-line treatment for various types of shoulder pain [20, 21]. According to research, acupuncture treatment is one of the few evidence-based nonpharmacologic therapies for pain management [22]. There is no doubt that numerous studies [23-25] have indicated the beneficial effects and safety of acupuncture for several chronic pain conditions; however, there are other studies that continue to raise concerns about the effects and safety of acupuncture for SPD. This query is raised when a reference is made to non-randomized studies. Randomized clinical trials (RCTs) are preferred by clinical researchers over non-randomized clinical trials because they are the gold standard study for evaluating health interventions and are considered the second level of evidence for clinical decision-making [26].

The argument about the effectiveness and safety of acupuncture for shoulder pain is still going on. But, at present, there are no proper narrative reviews conducted to evaluate the effect and application of acupuncture treatment for shoulder pain disorders in adults. The purpose of this study is to evaluate the clinical effect and application of acupuncture treatment for shoulder pain disorders (SPD) in adults. In order for acupuncture treatment for disorders of shoulder pain to be evaluated for its effectiveness and safety, a comprehensive critical analysis of its safety and efficacy must be conducted.

Methods

Search Strategy

This study follows the preferred narrative review format, IMRAD (Introduction, Aim, Methods, Results, Discussion, and Conclusion). There is a certain weakness in the quality of narrative reviews in comparison to systematic reviews. Therefore, by synthesizing some of the PRISMA guidelines, such as article selection methods (Figure 1), rigorous evaluation, results,

and evidence-based conclusions, the quality of the narrative review was attempted to be improved. A comprehensive search strategy was designed to search all the available literature related to this research topic. An electronic literature search was conducted on the following multiple electronic databases: PubMed, Google Scholar, PMC free articles, ScienceDirect, Eric, and Web of Science. The database language was set to English. Abstracts, reviews, full-text articles, clinical trials, systematic reviews, and randomized control trials were searched. Relevant controlled vocabulary supplemented with keywords such as “traditional Chinese medicine,” “alternative therapy,” “acupuncture,” “shoulder pain,” “shoulder disorder,” “pain relief,” and “acupuncture safety” was used to search for clinical trials of the effect and application of acupuncture treatment for shoulder pain disorders in adults. Multiple electronic databases from January 2012 to March 2022 were used to source articles for the review. The search process ended on March 15, 2022. Due to language limitations, only English databases were searched. Articles are screened according to the title and then selected after the abstracts are read. Only full-text articles that meet the inclusion criteria were downloaded.

Inclusion Criteria

Types of Studies

Regardless of publication type, the critical analysis included only RCTs of acupuncture for SPD, with or without blinding. Only studies with well-defined hypotheses, objectives, settings, participants (with inclusion and exclusion criteria), assessments, interventions, results, and conclusions were selected. The sample size of every study must be more than twenty patients. If the sample size is too small, the study is unlikely to produce any conclusive findings.

Types of Participants

All adult participants or subjects aged 18 years or older with shoulder pain disorders were

considered regardless of gender, race, ethnicity, region, and religion. The majority of the participants in these trials were outpatient clinic patients. All types of shoulder pain, whether acute or chronic, were considered as long as the area of the pain was localised to the scapula and humerus, with their surrounding muscles, tendons, and ligaments. Most types of shoulder pain, such as adhesive capsulitis, shoulder impingement, frozen shoulder, rotator cuff injury, labrum injury, bursitis, arthritis, tendonitis, and shoulder pain due to recovering from surgery, are included.

Types of Interventions

Acupuncture, either traditional Chinese acupuncture (MA), electroacupuncture (EA), or laser acupuncture, was compared to the following control interventions: sham acupuncture or sham EA; pharmacological (western medication); and other therapies or treatments such as physical therapy, physiotherapy, ultrasound, ESWT, physical training, ashi point acupuncture, trigger point acupuncture, or exercise therapy. Co-interventions were allowed as long as all trial arms received the same co-intervention. For the purposes of this analysis, there are no limitations on the types of needles, duration of treatment, or number of treatments. Only meridian acupuncture points, tender points (ashi points), and trigger points are considered.

Exclusion Criteria

The following criteria will be excluded from this study: (1) the duplicate articles as well as data that cannot be obtained or is incomplete; (2) other types of acupuncture, such as hydro acupuncture, fire needle acupuncture, or warm needle acupuncture, bee venom acupuncture, and small needle acupuncture (due to a lack of studies); (3) research involving acupuncture points other than those on the body (ear acupuncture or microsystem acupuncture); (4) participants with fractures, severe dislocations or sprains, terminal disease, mental illnesses,

cognitive impairment, or serious infection; (5) observational studies, cross-over studies, animal studies, conference abstracts, letters, and studies involving children; and (6) acupuncture plus other therapies, such as Chinese herbal medicine.

Outcome Measures

The primary outcomes include pain intensity. Scores or scales such as the Visual Analogue Scale (VAS), Numerical Rating Scale (NRS), Constant-Murley score (CMS), Patient Global Assessment (PGA), and Doctor Global Assessment (DGA) are used to assess pain intensity. Secondary outcomes include shoulder functions and the occurrence of adverse effects. The range of motion (ROM), the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, the Shoulder Pain and Disability Index (SPADI), and the Fugl-Meyer Motor Assessment (FMA) are all used to evaluate the shoulder pain and functionality of the shoulder.

Results

Search Results

The literature search for this study adopted the same features as the systematic review search methodology. Figure 1 shows a literature selection process for the study using some guidelines from the literature selection process in systematic reviews. The titles and abstracts of 1,161 potentially relevant studies were identified and screened for retrieval. A total of 493 citations were screened after duplicates were removed. Again, another 447 records were excluded, with reasons for not fulfilling inclusion criteria. 46 full-text publications were reviewed for potential inclusion. Again, another 24 full-text articles were excluded for not fulfilling further inclusion criteria. Finally, 22 studies were included in the qualitative synthesis. The full text of the articles could only be obtained when the abstracts discussed acupuncture treatment, its application and effectiveness for shoulder pain and shoulder disorders, the causes and effects of shoulder pain disorders, the safety of acupuncture treatment, the side effects of acupuncture, and the effects of combining acupuncture treatment with conventional medicine or other forms of alternative medicine.

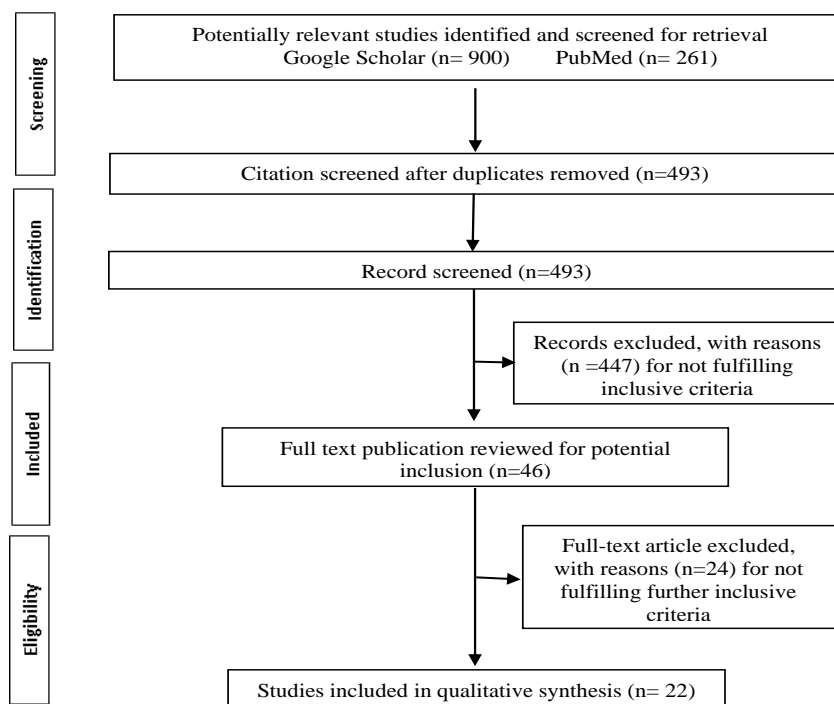


Figure 1. Flow Chart of the Literature Selection Process for the Study

Description of the Study

All 22 included RCTs were published in English. The included RCTs were published from the years 2005 to 2020. Table 1 and Table 2 show the summary characteristics of 22 RCTs of acupuncture for shoulder pain disorders. Six RCTs of acupuncture for shoulder pain disorders without co-intervention are summarized in Table 1, while sixteen RCTs of acupuncture for shoulder pain disorders with co-intervention are summarized in Table 2.

Of the 22 studies, twelve studies were from China [27-38], three studies were from Spain [39-41], two studies from Sweden [42, 43], two studies from Taiwan [44, 45], and one each from Turkey [46], Iran [47] and Greece [48]. The total number of participants are 1,808 person). The number of participants in each study ranged from 21 to 425 individuals. They were between the ages of 20 and 75. All the participants involved were diagnosed with SPD (clinical, as well as clinical and imaging). The conditions or diagnosis reported in these studies are: four cases of poststroke shoulder pain [35-38]; four cases of the frozen shoulder [34, 44, 45, 47]; one case of Scapulohumeral periarthritis [33]; three cases of supraspinatus tendinitis [29, 31, 48]; two cases of the unilateral subacromial syndrome [39, 41]; two cases of shoulder impingement syndrome [42, 43]; three cases of rotator cuff injuries or tears [27, 30, 32]; and three cases of chronic shoulder pain [28, 40, 46]. Only three studies revealed that participants experienced chronic shoulder pain.

The 22 studies used 12 manual acupuncture (traditional Chinese acupuncture) interventions [33-36, 38-39, 41-46] and six electroacupuncture interventions [27, 31, 48, 32,

45, 38]. One study used laser acupuncture [46], and another study used contralateral acupuncture [28]. Two studies used local non-acupuncture points (ashi points and trigger points) [37, 40]. Of the 12 studies, nine made use of both local and distal acupuncture points [34, 35, 38, 39, 42-46], while three based their treatment only on the distal acupuncture points [33, 36, 41].

The most frequently used acupuncture points in these studies were LI 15 (8 studies), TE 14 (8 studies), SI 9 (4 studies), and LI 14 (4 studies). LI-11 (Quchi) was frequently used for the treatment of post-stroke shoulder pain [35, 38], LI-15 (Jiayu) for the treatment of shoulder impingement pain [39, 42, 43], and LI-11 (Quchi) for the treatment of frozen shoulder [34, 44, 45]. The most common meridian types used are large intestine (LI) [10 studies], triple burner (TE) [9 studies], small intestine (SI) [7 studies], and stomach (ST) [4 studies]. Regarding needle positioning, four studies performed acupuncture on the affected parts directly [33, 37, 40, 46]. One study performed it on the healthy side (opposite side) of the affected shoulder [28]. The depth of the needle insertion ranged from 0.3 cm to 5 cm. The duration of needle retention was reported to be between 5 and 40 minutes. Among the 22 included studies, ten studies assessed acupuncture's effects on pain intensity using VAS [28, 33, 35, 37, 39, 43-47]. Two NRSs were used [40, 41]. Three studies assessed the acupuncture effects on shoulder function using CMS [33, 41, 42]. Six studies assessed the acupuncture effects on both shoulder pain and shoulder functionality using ROM [29, 32, 44-48]. Three studies assessed the acupuncture effects on both shoulder pain and shoulder functionality using SPADI [45-47].

Table 1. Summary Characteristics of 6 included RCTs of Acupuncture for Shoulder Pain Disorders without Co-interventions

Author/Year/ Country	Condition	Sample size (TG/CG)	Treatment duration	Without Co- Intervention (TG)	Control (CC)	Outcome measures <i>Adverse effects</i>	Results
Chen (2019) China	RC injury	40 (20/20)	6 weeks	EA	Exercise	1.Pain, function, shoulder ROM	1. Favours EA: TG>CG
			5 times/week			2. Post treatment	2.No difference: TG=CG
Kibar (2017) Turkey	Shoulder pain lasting more than 3 months	73 (36/37)	3 weeks	LA	Sham-LA	1.Reduction in SPADI	1.TG>CG (P<0.001)
			3 trial/week			2.Reduction in VAS	2.TG>CG (P<0.001)
						3.Reduction in PGA, DGA	3.TG>CG (P<0.001)
Garrido (2016) Spain	Unilateral injury with clinical symptoms	68 (35/33)	4 weeks	MA	Sham-MA	1.Reduction in VAS	1.G>CG (P<0.05)
			1 trial/week			2.Increase in Kruskal- Wallis test	2.TG>CG (P<0.05)
						<i>No severe adverse events</i>	
Johansson (2005) Sweden	Shoulder impingement syndrome	85 (44/41)	5 weeks	MA	Ultrasound	1.Reduction in CMS	1.TG>CG (P=0.045)
			2 trial/week			2.Increase in Kruskal- Wallis test	2.TG>CG (P=0.045)
						3.Increase in AI-score	3.TG>CG (P=0.045)
Zhang (2016) China	Chronic shoulder pain (Clinical)	80 (38/42)	TG: 4 weeks	Contralateral MA	PT	1.Pain VAS	1.Favours MA: TG>CG
			5 times/week			2.Reduction in VAS	2.No difference
			CG: 4 weeks Daily			<i>No adverse events</i>	

Ma (2006) Taiwan	Frozen shoulder	75 (30/30/15)	MA; 4 weeks 8 treatments	MA	1.PT	ROM, VAS, SF36 Health Survey (ADL) 1. Pain reduced in AC 2.ROM improved more in PT	1.TG<CG 2.MA + PT had the best outcome
			PT: 4 weeks 20 treatments				

Table 2. Summary Characteristics of 16 included RCTs of Acupuncture for Shoulder Pain Disorders with Co-interventions

Author /Year/Country	Condition	Sample size (TG/CG)	Treatment duration	With Co- Intervention (TG)	Control (CC)	Outcome measures <i>Adverse effects</i>	Results
Johansson (2019) Sweden	Shoulder impingement syndrome	91:(42/49)	5 weeks	MA+ Exercise	Corticosteroid injection + Exercise	1.Reduction in VAS 2.Increase in AI-score No severe adverse events	1.No differences 2.No differences
			2 trial/week				
Arias Buria (2017) Spain	Non-traumatic shoulder in pain	50: (25/25)	5 weeks	MA+ Exercise	Exercise	1.Reduction in NRS 2.Increase in DASH questionnaire No severe adverse events	1.No deference 2.TG>CG (P<0.01)
			1 trial/week				
			4 weeks				
Vas (2008) Spain	Unilateral subacromial syndromes	425:(205/220)	4 weeks	MA+ Physiotherapy	Mock TENS+ Physiotherapy	1.Reduction in CMS 2.Reduction in NRS No severe adverse events	1.TG>CG (P<0.001) 2.TG>CG (P<0.001)
			1 trial/week				
Chai (2019) China	Supraspinatus tendinitis	60:(30/30)	2 weeks	MA + tropical NSAID	ESWT+ tropical NSAID	Pain, shoulder abduction ROM Not reported	Favours MA: TG>CG No difference
			1 week post-treatment				
Lu. H (2019) China	Supraspinatus tendinitis (clinical)	40:(30/30)	TG:40 days/ once every other day	EA+ ESWT	ESWT	Pain, function, proportion of improved participants No adverse events	Favours EA: TG>CG No difference
			CG: 6 weeks Once a week				

Lu, M (2019) China	RC tear (Clinical and imaging)	60:(30/30)	3 weeks	MA +MT	MT	Proportion of improved participants <i>No adverse events</i>	Favours MA: TG>CG
							No difference
Papadopoulos (2019) Greece	Supraspinatus calcific tendinitis	40:(20/20)	TG: 3 weeks 2 session/week	EA + Oral medication + Exercise	Oral medication + exercise	Pain, ROM (forward elevation, abduction)	Favours EA +oral medication: TG>CG
			Oral medication:				No difference
			3 weeks/ session not reported				<i>Not reported</i>
			Exercise: 3 weeks 5 times daily				
Shi (2019) China	RC tear (Clinical and imaging)	104:(52/52)	6 weeks	EA+ MT	MT	Pain, function, ROM	Favours EA +MT
			Session not reported				TG>CG No difference
Lo (2020) Taiwan	Frozen shoulder syndrome	21 (11/10)	6 weeks	EA+PT	Sham EA+PT	1.Decrease in VAS	1.TG>CG
			18 sessions 2-3 session/week				2.No significant change between the two groups in VAS, SPADI. ROM in the follow-up periods
Zhang (2019) China	Scapulohumeral periartthritis	64 (32/32)	4 weeks	MA + Ashi points	Ashi points	VAS, CMS, HAMA, cured, effective, or ineffective	TG>CG Significant improvement of both groups compared to the control.
			6 times/week				<i>Not reported</i>
Asheghan (2016) Iran	Frozen shoulder	40 (20/20)	MA: twice/week PT: once every other day	MA + PT	PT	SPADI, VAS, ROM Follow-up: 1.5 months 3 months	In ROM TG>CG After 3 months: VAS TG>CG (P < 0.05).No difference in SPADI

				6 weeks					<i>Not reported</i>	
Shang (2012) China	Frozen shoulder	64 (32/32)		12 Days	MA + AQF	MA			Cured, improved: failed ADLPain and moving functions of shoulder and ADL improved.	TC>CG (P<0.05). Statistically significant improvement in both groups
				once every day					<i>Not reported</i>	
Gao (2014) China	Poststroke shoulder pain	75 (25/25/25)		4 weeks	MA + RH	1. MA 2. RH			1.Decrease in VAS	1.TC>CG (P<0.001)
				6 times/week					2.Improve in FMA	2.Had a significant effect
				4 weeks	MA + RH	RH			<i>No adverse events</i>	
Sheng & Shi (2013) China	Poststroke shoulder pain	60 (33/27)		4 weeks	MA + RH	RH			FMA	TC>CG (P<0.001) Had a significant effect
				Once every day					<i>No adverse events</i>	
Ni (2013) China	Poststroke shoulder pain	64 (32/32)		60 days	MA + RH	RH			1.Decrease in VAS	1.TC>CG (P<0.001)
				Once every day					2.Improve in FMA	2.Had a significant effect
				30 days	EA + RH	1. EA 2. RH			<i>No adverse events</i>	
Bao (2012) China	Poststroke shoulder pain	129 (46/41/42)		Once every day					FMA	TC>CG (P<0.001)
									Improve in FMA	Had a significant effect
									<i>No adverse events</i>	

MA: manual acupuncture; EA: electroacupuncture; PT: physical training; MT: manual therapy; RH: rehabilitation treatment; NRS: numeral rating scale; DASH: disability of arm, shoulder, and hand; NSAID: non-steroidal anti-inflammatory drug; TENS: transcutaneous electric nerve stimulation; RC: rotator cuff; ESWT: extracorporeal shock wave therapy; HAMA: hamilton anxiety scale; FMA: the fugl-meyer assessment; AOF: accelerating Qi-flow along meridians.

Effects of Interventions on Pain, Shoulder Function, and Adverse Events

Acupuncture Versus Sham Acupuncture

Two studies compared acupuncture treatment with sham acupuncture [39, 46]. Both studies observed that there was a significant reduction in VAS scores, an improvement in the Kruskal-Wallis test, a reduction in SPADI scores, and a reduction in PGA and DGA scores in the acupuncture group compared to the control groups. Both studies showed that acupuncture treatment is more effective than sham acupuncture in terms of shoulder pain reduction and improvement in shoulder functions. In comparison, the study showed that laser acupuncture is more effective than manual acupuncture. One study reported that no adverse events occurred during the trial [39], whereas the other study did not provide any data on adverse events [46]. The studies concluded that, when compared to sham acupuncture, acupuncture treatment has a significant impact on the recovery of shoulder pain and shoulder functionality.

Acupuncture Versus Non-Pharmacological Interventions

Three studies compared acupuncture with non-pharmacological interventions such as physical therapy, exercise therapy, and ultrasound treatment. [28, 27, and 42]. Acupuncture treatment showed favorable results on pain reduction measured using VAS scores compared to physical therapy [28], ultrasound treatment [42], and exercise therapy [27]. Although the results showed an increase in DASH score [27] and a high CMS score [28], both studies [27, 28] concluded that there was no significant difference between the acupuncture group and the control group (exercise therapy and physical therapy) in reducing pain and improving shoulder functions. However, one study [42] found a significant difference in pain reduction and improvement in shoulder function in acupuncture treatment compared to

ultrasound treatment. These studies showed that acupuncture produced the same therapeutic effect as physical therapy and exercise therapy but had a better effect on shoulder pain recovery compared to ultrasound therapy.

Acupuncture Versus Non-Pharmacological Interventions and Acupuncture Plus, Non-pharmacological Interventions

One study [44] compared acupuncture with non-pharmacological interventions (physical therapy) and acupuncture plus non-pharmacological interventions (physical therapy) for frozen shoulders. ROM, VAS, and Health Survey (ADL) indicators were used to measure pain intensity, shoulder function, and quality of life. Both the intervention and control groups showed improvements in quality of life as measured by the Health Survey. The results showed that pain was reduced in the acupuncture group, while shoulder function improved in the physical therapy group. The results concluded that acupuncture treatment plus physical therapy as a combined intervention had a better outcome than acupuncture or physical therapy alone. The initial results showed a noticeable decrease in shoulder pain measured using VAS, improvement in shoulder pain and shoulder function measured using SPADI, and improvement in shoulder function measured using ROM in both the treatment group and control group. However, the end results showed no significant difference between the two groups in VAS scores, SPADI scores, and ROM scores in the follow-up periods. The findings showed that both the treatment group and the control group had the same therapeutic effects on shoulder pain disorders.

Acupuncture Plus Non-Pharmacological Interventions Versus Non-Pharmacological Interventions

Nine studies compared acupuncture plus non-pharmacological interventions with non-pharmacological interventions. The non-

pharmacological interventions included in this study are manual therapy, ashhi points, physical therapy, rehabilitation treatment, manual therapy, ESWT, exercise therapy, and acupuncture. In terms of shoulder pain and function improvement, seven studies found a statistically significant difference between the acupuncture group and acupuncture alone [32], physical therapy alone [45], rehabilitation therapy alone [34, 35]; manual therapy alone [30], ESWT alone [29], and ashhi point treatment [31]. These findings demonstrated the efficacy of acupuncture therapy for SPD. One study showed that acupuncture plus exercise therapy had no significant effect on shoulder pain reduction, but there was a significant improvement in shoulder function when compared to exercise therapy alone [38]. However, another study showed that acupuncture plus manual therapy had no significant effect on shoulder pain reduction and shoulder function improvement when compared to manual therapy alone [28].

Acupuncture Plus Non-Pharmacological Interventions Versus Non-Pharmacological Interventions and Non-Pharmacological Interventions

Two studies compared acupuncture plus non-pharmacological interventions with non-pharmacological interventions and another non-pharmacological intervention. One study compared electroacupuncture plus rehabilitation treatment with electroacupuncture and rehabilitation treatment [38], whereas another study compared manual acupuncture plus rehabilitation treatment with manual acupuncture and rehabilitation treatment [35]. Both studies showed that the acupuncture plus rehabilitation treatment groups were superior to the acupuncture group and the rehabilitation treatment group alone. Both studies showed significant improvements in the FMA score. However, one study showed significant improvements in VAS score [35] and another study showed significant improvements in FMA

score. The results of the observations indicated that acupuncture had a significant impact on pain relief and shoulder function improvement among the participants in both studies.

Acupuncture Plus Non-Pharmacological Interventions Versus Same Non-Pharmacological Interventions Plus Another Non-pharmacological Interventions

One study [41] compared acupuncture plus physiotherapy with mock Tens plus physiotherapy. The observation showed a significant reduction in the CMS score ($p > 0.001$) and a significant reduction in the NRS score ($p > 0.001$). Acupuncture plus physiotherapy was found to be more effective than mock tens plus physiotherapy. These demonstrated that there was a significant difference between acupuncture plus physiotherapy and Mock Tens plus physiotherapy for pain relief and shoulder function improvement at the end of four weeks of treatment. According to these findings, acupuncture had a significant impact on pain relief and shoulder function improvement compared to mock TENS plus physiotherapy at the end of the trials.

Acupuncture Plus Non-Pharmacological Interventions Versus the Same Non-Pharmacological Interventions Plus Pharmacological Interventions

One study [43] compared acupuncture plus exercise with exercise plus corticosteroid injection. The non-pharmacological intervention in this study was exercise therapy and the pharmacological intervention was corticosteroid injections. The study showed a significant reduction in the VAS score and a significant improvement in the AI-score in both groups. The observation showed that acupuncture plus exercise and corticosteroid injection plus exercise have a similar effect in terms of pain reduction and shoulder function improvement among patients suffering from shoulder

impingement syndrome. However, the results showed that there were no significant differences between the acupuncture plus exercise group and the corticosteroid injection plus exercise group. These results clearly indicate that acupuncture is not superior to corticosteroid injections or vice versa in treating SPD. The outcomes showed that both acupuncture therapy and corticosteroid injections are equally effective at reducing shoulder discomfort and enhancing shoulder functionality among SPD patients.

Acupuncture Plus Pharmacological Interventions Versus Non-Pharmacological Interventions Plus Pharmacological Interventions

Two studies compared acupuncture plus pharmacological interventions with non-pharmacological interventions plus Pharmacological Interventions. One study [29] compared acupuncture plus topical NSAIDs with ESWT plus topical NSAIDs, whereas another study [48] compared electroacupuncture plus oral medication plus exercise with oral medication plus exercise. The results from [29] study showed that the mean VAS score was much lower in the treatment group compared to the control group. Obviously, the results favor acupuncture treatments plus topical NSAIDs more than extracorporeal shock wave therapy (ESWT) plus topical NSAIDs. However, the study demonstrated that there was no significant difference between the treatment group and the control group. According to these findings, both groups had an equivalent impact on the participants with SPD in terms of reducing pain and enhancing shoulder function. Another study [48] compared electroacupuncture plus oral medication plus exercise with oral medication plus exercise. The results showed that there was a modest reduction in pain in the acupuncture group compared to the control group. However, there was a remarkable improvement in shoulder function in the acupuncture group compared to the control group. Again, the results favor acupuncture treatments plus oral medication

plus exercise more than oral medication plus exercise in terms of pain reduction and shoulder function improvement. However, the trial demonstrated that there was no significant difference between the treatment group and the control group in pain reduction and shoulder function improvement in the participants with SPD.

Adverse Events

Out of 22 studies, only 13 studies provided information on adverse events during the acupuncture treatment for SPD [28, 30, 31, 34-43, 45]. None reported any serious adverse events that occurred throughout the study period. Only a minor adverse event was reported in one study [41]. In this study, gastralgia was reported as a side effect of treatment in 3% of the acupuncture plus physiotherapy group and 5% of the mock TENS plus physiotherapy group (control group). Anyhow, the duration of this adverse event was not mentioned in any detail. This study indicated that there are some possibilities for minor adverse events in acupuncture treatments. However, the study showed that acupuncture is still a safe treatment. The remaining nine studies did not provide any details about adverse events in their studies [27, 30-32, 42, 44-46]. Overall, the findings indicated that acupuncture is a safe procedure with few side effects.

Discussion

Summary of the Main Findings

This study investigated and evaluated the clinical effects and application of acupuncture treatment for shoulder pain disorders in adult patients with SPD by critically analyzing 22 RCTs involving 1,808 participants. Most studies compared acupuncture either alone, in combination with active comparators, or with an active comparator alone, indicating that the current body of evidence has been primarily concerned with assessing the additive effects or comparative efficacy of acupuncture in comparison to other interventions. The studies

demonstrated that acupuncture treatment is better and more effective than sham acupuncture [39] and ultrasound treatment [42]. Laser acupuncture is much better than manual acupuncture. Studies have shown that acupuncture treatment can produce the same positive effects as exercise therapy, physical therapy, accelerating Qi-flow along the meridian (AOF), and ashi point acupuncture in reducing pain and improving shoulder function among SPD patients [27, 28, 33, 34, 40, 42, 47]. These observations indicated that acupuncture treatment can effectively replace ultrasound treatment, exercise therapy, and physical therapy for treating SPD. The same effects were observed in studies comparing acupuncture with pharmacological interventions such as the usage of tropical NSAIDs, oral medications, and corticosteroid injections [29, 43, 48]. There was no significant difference between acupuncture treatment and pharmacological intervention such as diclofenac gel, prednisolone, or triamcinolone, oral medicine such as oral analgesics and non-steroidal anti-inflammatory drugs, and corticosteroid injections such as hydrocortisone, triamcinolone, and methylprednisolone, which come with some adverse events. This finding indicates that acupuncture treatment alone can produce the same therapeutic effect for shoulder pain and shoulder function recovery as pharmacological interventions. Therefore, in such a case, the best option to replace the use of pharmacological interventions for SPD in this situation is acupuncture, which is safe, effective, and free of any serious adverse events. This finding is supported by a study stating that acupuncture is increasingly used as a non-drug therapy for shoulder pain. In addition to enhancing blood circulation and energy (Qi) flow, acupuncture also blocks pain signals sent by other nerves and chronic pain-carrying nerves while also releasing chemicals that block pain [49].

Acupuncture treatment was found to be more effective when combined with other treatments or therapies such as exercise therapy, physical

training, accelerating Qi-flow along meridians (AOF), ashi points, and rehabilitation. These findings indicated that combined acupuncture interventions are much more effective than single acupuncture treatments [34, 35, 36, 37, 38, 41]. Again, these findings suggest that combined acupuncture treatments produce a better outcome in treating SPD by significantly improving shoulder function and reducing shoulder pain. Again, in this study, acupuncture was shown to be a safe treatment with significant effects in regard to reducing pain and improving shoulder function in the short and medium terms. However, there was no evidence to support the use of acupuncture for long-term outcomes in patients with SPD, as all trials reported short-term results, and roughly half provided intermediate-term results. Overall, acupuncture's short-term advantages were found to have some certainty of evidence when compared to the same active comparison when used alone or in combination. Even though there was a high prevalence of incomplete reporting of safety data in the studies included in this review, the reported adverse events were minor and infrequent. Although there is some evidence for an effect of acupuncture treatment on shoulder pain disorders, the results are not conclusive. Therefore, due to a large number of confounding factors and significant unexplained heterogeneity, the results must be interpreted with extreme caution.

Implication for Clinical Practice

Based on the findings from the RCTs, short-term benefits of acupuncture treatment for SPD were observed. When applying acupuncture alone or as an adjunct therapy to ultrasound, physical training, physiotherapy, ashi points, AOF, and rehabilitation, acupuncture might benefit the treatment of SPD. Most studies compared acupuncture either alone or in combination with active comparators or with active comparators. Most trials reported short-term outcomes, and almost half provided intermediate-term outcomes. The preliminary

findings support the benefits of acupuncture in terms of pain reduction and shoulder function. The long-term effects of acupuncture on SPD were not investigated in this study. Therefore, whether acupuncture can yield a long-term improvement in shoulder pain and shoulder function in patients with SPD remains unclear. There were numerous confounding variables, such as age range, sample size, number of acupuncture points, duration of treatment, ideal treatment regime, and types of acupuncture. Therefore, any regimen of intervention or an ideal standardized regime cannot be endorsed for this current study. The overall low quality of the included studies necessitates further confirmation of the current findings in well-designed RCTs in the future.

Implication for Future Research

Age, gender, the severity or condition of the case, the types of interventions, and withdrawals or drop-outs along with the reasons should all be clearly recorded and reported. Age and gender factors should be considered [50]. Essential information on specific acupuncture points, types of needles, insertion depth, insertion angle, deQi sensation, needle manipulation techniques, retention time, length of the treatment, follow-ups, and sham acupuncture must be provided in detail. In the future, high-quality RCTs in a variety of settings should be conducted with the statistical power to produce significant results. Validated instruments or indicators for outcome measures should be used to assess the clinical effects of the intervention. More evidence is required to support acupuncture's benefits for patient satisfaction, long-term healing, and improvement of quality of life. Every adverse event should be recorded and clearly reported. It should be noted that a complete description of the safety of the interventions must be reported explicitly.

Limitation

The limitation of this study was that the number of RCT studies selected was small, of

poor quality, and had methodological shortcomings. The current study only searches English-language electronic databases to identify potential studies published in English due to language barriers and limited access to databases developed in other languages. Therefore, papers published in other languages, such as Chinese, Japanese, Korean, German, or Spanish, may have been missed. In addition, the present study did not include non-RCTs and incorporated unpublished data, which may result in the loss of important information in the field. Some of the studies were unable to provide a valid measurement technique. A number of studies used less common measurement tools, and the calculation method is not fully described. Only two studies, out of the 22 included studies, compared the acupuncture group to a sham acupuncture group in order to eliminate the placebo effect. The large variety of measurement tools in SPD studies makes critical analysis much more difficult. Treatment duration for the majority of the studies was 1-4 weeks, and not all studies continue with follow-up. The follow-up time of 1 year should stand as the standard follow-up for SPD due to its long recovery time without treatment of 1-4 years.

Conclusion

In this critical analysis, acupuncture was shown to be a safe treatment with a significant effect on reducing shoulder pain, improving shoulder function, and overall increasing the quality of life. Acupuncture has been shown to relieve pain by promoting energy (qi) or blood circulation, blocking pain signals through chronic pain-carrying nerves and other pain nerves, and releasing pain-relieving chemicals. The results indicated that acupuncture treatment could effectively replace ultrasound treatment, exercise therapy, and physical therapy for treating SPD. The same effects were observed in studies comparing acupuncture with pharmacological interventions such as the usage of tropical NSAIDs, oral medications, and

corticosteroid injections. Therefore, acupuncture may be an effective and safe treatment for SPD.

However, very low-certainty evidence for the short-term benefit of acupuncture alone or acupuncture combined with other active treatments was observed compared with other active treatments. The reported benefits should be interpreted with great caution because of the small number of included studies, small sample size, methodological limitations, incomplete reporting, and substantial unexplained heterogeneity. To reach a robust conclusion, a more rigorous study design, a larger sample size, and high-quality RCTs are needed to determine the effectiveness and safety of acupuncture treatment for SPD. Longer follow-up times are also required to investigate the effects of acupuncture in the medium and long term. The duration of future SPD study follow-up should be increased to one year. Future studies should compare acupuncture to other popular alternative treatments such as cupping therapy, moxibustion, herbal medicine, chiropractic, acupressure, arthroscopic capsular release, hydro dilatation, and manipulation under anesthesia. Because a wide range of

measurement tools are used in SPD studies, the homogeneity of the results is compromised; therefore, it is recommended that reliable tools and measurement scales be used. Further clinical studies involving acupuncture must use an optimal form of treatment. Through rigorous designs, reasonable evaluations, and critical analyses, it is possible to arrive at a more robust conclusion on the efficacy and safety of acupuncture treatment for shoulder pain disorders.

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Conflicts of Interest

The authors have no conflicts of interest to declare.

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