

# Application of Acupuncture for Shoulder Pain Over the Past 22 Years: A Bibliometric Analysis

Yu-Ling Chen<sup>1-3,\*</sup>, Yu-Dan Liang<sup>4,\*</sup>, Kai-Feng Guo<sup>2</sup>, Zhen Huang<sup>2</sup>, Wen-Qi Feng<sup>3</sup>

<sup>1</sup>Rehabilitation Department of the Panyu Central Hospital, Guangzhou University of Chinese Medicine, Guangzhou, People's Republic of China;

<sup>2</sup>Rehabilitation Department of the Panyu Central Hospital, Guangzhou, People's Republic of China; <sup>3</sup>Department of Acupuncture and Moxibustion of the YiBin Hospital of Traditional Chinese Medicine, YiBin, People's Republic of China; <sup>4</sup>Department of Acupuncture and Rehabilitation, the Affiliated Jiangmen Traditional Chinese Medicine Hospital of Jinan University, Jiangmen, People's Republic of China

\*These authors contributed equally to this work

Correspondence: Zhen Huang, Rehabilitation Department of the Panyu Central Hospital, No. 8 Fuyu Road, Qiaonan District, Guangzhou, 511400, People's Republic of China, Tel +86 18922238059, Email Mishz@126.com; Wen-Qi Feng, Department of Acupuncture and Moxibustion of the YiBin Hospital of Traditional Chinese Medicine, No. 2 Dawan Road, Nanan District, YiBin, 644000, People's Republic of China, Tel +86 13629031868, Email Moonly1981@163.com

**Purpose:** Acupuncture is widely used to relieve shoulder pain. A survey was conducted in order to recognize hotspots and frontiers of acupuncture for shoulder pain from the year 2000–2022.

**Methods:** The Web of Science Core Collection was used to collect literature related to acupuncture therapy for shoulder pain, which spanned January 2000 to August 2022. The number of publications yearly, countries/institutions, journals, and keywords was analyzed and visualized in shoulder pain with acupuncture therapy by CiteSpace v.5.7.R5.

**Results:** We totally analyzed 214 articles that met the inclusion criteria. The overall trend of publication volume continues to increase. The most productive authors in the field were César Fernández las Peñas and José L Arias-Buría, and the most influential author was Green S. Kyung Hee University and the People's Republic of China had the highest volume of publications, respectively. The most influential journal is Pain with high citation and impact factor. The hot keywords were “acupuncture”, “shoulder pain”, “dry needling”, “randomized trial”, and “injection”. The research frontier in acupuncture for treating chronic shoulder pain was mainly “mechanism”.

**Conclusion:** Over the last 22 years, the findings of this bibliometric analysis have provided research trends and frontiers in clinical research on acupuncture therapy for patients with shoulder pain, which identifying hot topics and exploring new directions for the future may be helpful to researchers. Studying mechanisms underlying acupuncture therapy for shoulder pain remains a focus of future research.

**Keywords:** acupuncture, shoulder pain, bibliometric analysis, CiteSpace

## Introduction

Shoulder pain encompasses both joint and muscular pain. Most commonly, shoulder pain is caused by periarthritis of the scapula and humerus, shoulder fasciitis, rotator cuff injuries, poststroke shoulder pain, and acromial impingement syndrome. Shoulder pain affects the physiological function of the shoulder and reduces workforce efficiency, which eventually causes joint deformities or even disability.<sup>1,2</sup> Acupuncture is a traditional Chinese medicine (TCM) technique with widely acknowledged analgesic properties. It is frequently used to treat a variety of acute and chronic pain conditions, including shoulder pain.<sup>3</sup> Acupuncture has been shown in studies to have high confidence evidence for its function as an analgesic.<sup>4</sup> Interfering with pain by acupuncture, these ways of intervention are as follows: anti-inflammatory pain, inhibiting the generation of painful chemicals, affecting painful signaling pathways, and intervening in peripheral sensitization mechanisms.<sup>5</sup> In recent years, with the deepening of research, the mechanism of acupuncture in the treatment of shoulder pain is as follows: it can reduce serum inflammatory factors and pain factors;<sup>6</sup> Mediating the release of chemicals to relieve pain;<sup>7</sup> Improve shoulder joint pain sensitivity;<sup>8</sup> Effectiveness and safety of different needles in the treatment of shoulder pain. The study of bibliometrics has provided a research frontier in this field.

CiteSpace was applied to conduct a bibliometric analysis to understand research trends and hot topics in diverse fields of study.<sup>9</sup> A bibliometric analysis of acupuncture's global use for shoulder pain has yet to be conducted, however. In this study, we used CiteSpace to conduct a visualization analysis of linked references in acupuncture for treating shoulder pain generated from the Web of Science (WoS) database to construe research hotspots and development patterns and give a reference for future research. Here, through the nodes and links composed, knowledge maps of bibliometric analysis and visualization are achieved by CiteSpace.

# Materials and Methods

## Data Collection

The literature was extracted from the SCI-EXPANDED database in the WoS Core Collection. From January 1, 2000, to August 22, 2022, we searched for the topics “acupuncture” and “shoulder pain” and downloaded all the data the same day (Table 1). There were no language restrictions, and 271 studies were found. Our analysis and visualization of the data included 214 records. Inclusion Criteria: All issues relevant to acupuncture and shoulder pain were listed and spanned from 2000 to 2022. The type of publications was confined to original research papers, reviews, meta-analyses, perspectives of clinical and case report.

Excluding Criteria: After reviewing the abstracts and excluding editorials, materials, letters, conference abstracts, or full-text literature is not available. These papers were saved in a text file named “download\_”.

## Analysis Tool

The data was collected and visualized, combined with CiteSpace (v.5.7.R5) and Excel for analysis. In the visualization analysis, we specifically set the “Top N% per slice” criteria to 50 for all computations. The analysis period covered January 2000 to 2022, with 1 year slices in CiteSpace for all analyses.

## Data Analysis

A log-likelihood ratio algorithm was used to extract clustering labels: We use Microsoft Excel to generate the graph of publications trends and use software to analyze the map knowledge of authors, countries/institutions, and keywords. We can learn about knowledge cooperation and research structure through cluster analysis, co-citation, and keyword analysis. In addition, it also summarizes the publishing trends from 2000 to 2022. The size of the node is frequently used to

**Table 1** Search Queries

SET	Results	Search Query
#1	21,138	TS=(“ACUPUNCTURE” OR “ELECTROACUPUNCTURE” OR “FILIFORM NEEDLE” OR “INTRADERMAL NEEDLING” OR “IMBEDDING NEEDLE” OR “NEEDLE-KNIFE” OR “WARM ACUPUNCTURE” OR “INTERNAL THERMAL NEEDLES” OR “ACUPOINT CATGUT EMBEDDING” OR “DRY NEEDLING” OR “FIRE NEEDLE” OR “HEATED NEEDLE” OR “ACUPUNCTURE POINT INJECTION THERAPY” OR “WET NEEDLING” OR “MOXIBUSTION” OR “EAR MOTIONAL ACUPUNCTURE”)
#2	537	(TS=(“SHOULDER PAIN”)) AND TS=(“STROKE” OR “CEREBROVASCULAR ACCIDENT” OR “APOPLEXY” OR “BRAIN VASCULAR ACCIDENT” OR “CEREBROVASCULAR STROKE” OR “HEMIPLEGIA” OR “MONOPLEGIAL”)
#3	18,527	TS=(“ROTATOR CUFF” OR “ROTATOR CUFF INJURY” OR “ROTATOR CUFF TENDINOSES” OR “ROTATOR CUFF TEARS” OR “SHOULDER PAIN”)
#4	1151	TS=(“SCAPULOHUMERAL PERIARTHRTIS” OR “PERIARTHRTIS OF SHOULDER” OR “PERIARTHRTIS HUMEROSCAPULARIS” OR “FROZEN SHOULDER” OR “SHOULDER PERIARTHRTIS” OR “ADHESIVE CAPSULITIS OR SHOULDER PAIN”)
#5	19,262	#2 OR #4 OR #3
#6	271	#5 AND #1

estimate the frequency of appearance or citation; Nodes with different colors indicate different years, a circle of each color represents each year from 2000 to 2022. In addition, the relationships of cooperation, cooccurrence, and cocitation are represented by the lines between the nodes. The centrality of a node is represented by a purple circle, and nodes with high centrality are typically regarded as crucial or critical locations in a field.

## Results

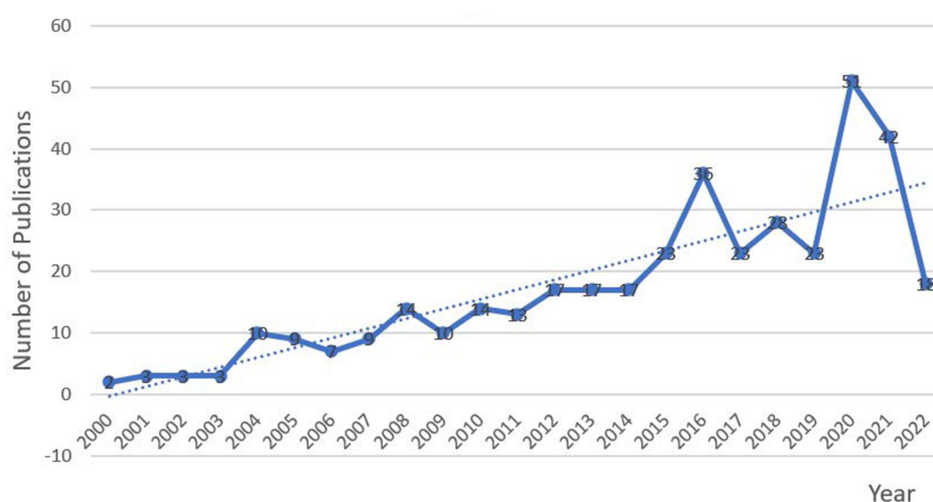
### Annual Publication Outputs and Time Trend

With some fluctuations over the study period, the total number of publications has increased since 2000 (Figure 1). The first stage, termed the budding phase, ran from 2000 to 2015, and the total number of publications gradually increased. 2016 to 2020 was a period of rapid development, termed the initial development period, and 2021 to 2022 was another period of rapid development. Since 2021, the fallback phase began, thereby publication outputs decreased.

### Visualization Analysis of Authors and Author Co-Citations

#### Visualization Analysis of Authors

The authoritative scholar's teams and representatives can be revealed through the map of authors in the field of acupuncture for shoulder pain. Readers may remain current on publishing trends, tracking, and collaborative research in this subject by scanning visualization analysis for the co-authors. The mapping of co-author generated using CiteSpace resulted in 447 nodes and 911 links in Figure 2 shows. César Fernández las Peas (11), José L. Arias-Bura (5), Andrew J. Vickers (5), Cunzhi Liu (5), and Heera Shin were the top five authors in terms of frequency (4). The most productive author was César Fernández las Peas, who explored the effectiveness of dry needles in treating subacromial myofascial trigger points in shoulder pain. The following four core teams were created, with the information of Figure 2: The teams led by César Fernández las Peas and José Luis Arias Bura investigated the efficacy of dry needling for the relief of pain brought on by subacromial myofascial trigger points,<sup>10</sup> and Andrew J Vickers' team primarily analyzed the meta-analysis of the majority of available research on acupuncture therapy for shoulder pain, which illustrated the analgesic benefit of acupuncture, although the mechanism remains unclear.<sup>11</sup> Using functional magnetic resonance imaging, Cunzhi Liu's team investigated the mechanism of acupuncture in the treatment of shoulder pain and brain nerve conduction and excitation, as well as the correlation between central and peripheral sensitization and analgesics during acupuncture of shoulder acupoints.<sup>12</sup> The research teams of Heera Shin and Seung-Ryong Yeom primarily devoted themselves to the treatment of chronic pain caused by local periartthritis of the shoulder or acromion impingement syndrome, indicating that acupuncture and moxibustion had greater clinical effectiveness and safety.<sup>13</sup>



**Figure 1** Annual publications from 2000 to 2022 and the time trend of acupuncture treatment for shoulder pain.



**Figure 2** Network map of co-authorship between authors about acupuncture treatment for shoulder pain.

### Visualization Analysis of Author Co-Citations

A co-citation author map generated 419 network nodes and 1201 links, as illustrated in [Figure 3](#). The top five co-authors were ranked as follows in chart: Green S (43), Molsberger AF (29), De Hoyos JAG (27), MacPherson H (26), and Vickers AJ (23). The top five authors in terms of centrality were Ceccherelli F (0.37), Buchbinder R (0.35), Berry H (0.28), Brox JI (0.25), and Chan AW (0.25). The above analyses revealed that Green S was particularly influential and representative and focused mainly on acupuncture for shoulder pain caused by shoulder periarthritis and rotator cuff injury, including combined therapy with physical therapy and other acupuncture related to traditional acupuncture for shoulder pain.<sup>14</sup>

### Visualization Analysis of Country and Institution

To comprehend scientific research, variations in the research level, and academic authority of countries and institutions, we created a map of quantitative analysis with publications of countries and institutions. The outcome was 27 nodes and 39 linkages ([Figure 4](#)). The top five countries were People's Republic of China (65), the United States (47), South Korea (29), Spain (24), and England (15), and the top five countries in terms of centrality (purple round) were the United States (0.36), Peoples R China (0.32), England (0.15), Spain (0.1), and Australia (0.06; [Table 2](#)). China contributed the most publications in the field; however, from the viewpoint of network centrality, the United States still occupies an essential position in the field of acupuncture treatment for shoulder pain, with more collaborative countries and higher international influence.

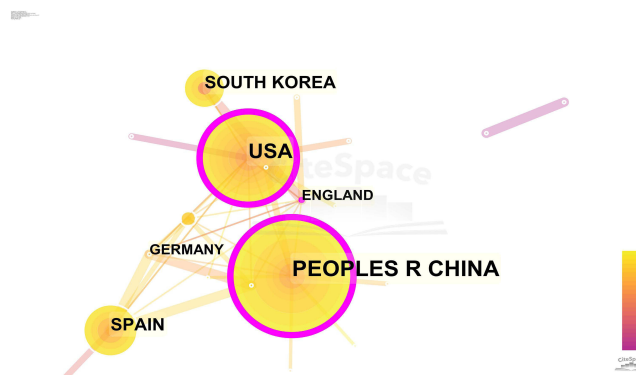
### Visualization Analysis of Institution

Generating an institution map using CiteSpace resulted in 313 nodes and 512 links ([Figure 5](#)). The top five institutions in publication were Kyung Hee University (10), Universidad Rey Juan Carlos (8), China Medical University (8), Memorial Sloan Kettering Cancer Center (7), and Wonkwang University (7); the degree of centrality in CiteSpace for all the cooperating institutions in the network was <0.1. This shows that there is relatively little cooperation in among agencies, resulting less influence the at international level, and most of these institutions conduct independent research. Exchanges





**Figure 3** Network map of co-cited author between authors about acupuncture treatment for shoulder pain.



**Figure 4** Network map of co-authorship between countries or regions about acupuncture on shoulder pain.

and cooperation among research institutions are limited internally, with the largest number of publications and largest number of research institutions in China, but less cooperation among research institutions.

## Visualization Analysis of Co-Cited Journals

As shown in Figure 6, Generating a co-citation journals map resulted in 273 network nodes and 793 links. (Table 3) The top five co-cited journals were Pain (124), Archives of Physical Medicine and Rehabilitation (90), Cochrane Database of Systematic Reviews (85), BMJ: British Medical Journal (76), and Acupuncture in Medicine (68). The top five journals in terms of centrality were Archives of Physical Medicine and Rehabilitation (0.34), Physical Therapy (0.28), Annals of Rheumatic Diseases (0.21), American Journal of Sports Medicine (0.18), and Acupuncture in Medicine (0.16). Pooled analysis of the abovementioned studies showed that Pain was the most influential journal in acupuncture analgesics, especially in acupuncture for shoulder pain.

**Table 2** The Top Five Active Countries/Regions

Country	Counts	Country	Centrality
Peoples R China	65	United States	0.36
United States	47	Peoples R China	0.32
South Korea	29	England	0.15
Spain	24	Spain	0.1
England	15	Australia	0.06

The top 10 journals (ranked by impact factor) are presented in Table 4. The mean impact factor was 3.3878. Pain had the highest impact factor of 7.926, the largest number of publications, and was the most influential journal. Journals with impact factors >5 were Journal of Orthopedic & Sports Physical Therapy and Pain; those with impact factors between 3 and 5 were Pain Medicine and European Journal of Pain; those with impact factors between 2 and 3 were Evidence-based Complementary and Alternative Medicine; Journal of Pain Research; and those with impact factors between 1 and 2 were Medicine, Journal of Manipulative & Physiological Therapeutics, Acupuncture in Medicine, and European Journal of Integrative Medicine. The majority of research was heavily concentrated in journals on acupuncture for shoulder pain with impact factors between 1 and 3.

## Visualization Analysis of Co-Cited References

Co-cited references can help us quickly understand the knowledge base of this field.<sup>15</sup> Figure 7<sup>11,16–30</sup> indicates that generating a cited reference co-citation map resulted in 472 nodes and 1355 links. According to Table 5 and Table 6, the main references focus on the meta-analysis of dry needling in the treatment of chronic shoulder pain

**Figure 5** Network map of co-authorship between institutions about acupuncture treatment for shoulder pain.



**Figure 6** Network map of co-cited journals about acupuncture treatment for shoulder pain.

based on fascial theory and literature analysis of the application of acupuncture in the treatment of chronic shoulder pain in patients with shoulder pain caused by hemiplegia or shoulder pain caused by rotator cuff injury.<sup>14,16,20,23,24,26,30,31</sup>

**Table 3** The Top Five Co-Citation Journal in Shoulder Pain

Journal	Publications	Journal	Centrality
Pain	124	Archives of Physical Medicine and Rehabilitation	0.34
Archives of Physical Medicine and Rehabilitation	90	Physical Therapy	0.28
Cochrane Database of Systematic Reviews	85	Annals of Rheumatic Diseases	0.21
BMJ-British Medicine Journal	76	American Journal of Sports Medicine	0.18
Acupuncture in Medicine	68	Acupuncture in Medicine	0.16

**Table 4** Distribution of Top 10 Journals on Acupuncture for Shoulder Pain

Rank	Journal Title	Country	Counts	IF 2021
1	<i>Medicine</i>	United States	15	1.817
2	<i>Evidence-based Complementary and Alternative Medicine</i>	England	10	2.65
3	<i>Acupuncture in Medicine</i>	England	7	1.976
4	<i>Journal of Orthopedic &amp; Sports Physical Therapy</i>	United States	7	6.276
5	<i>Journal of Manipulative and Physiological Therapeutics</i>	United States	6	1.3
6	<i>Pain</i>	United States	6	7.926
7	<i>Pain Medicine</i>	United States	5	3.637
8	<i>Journal of Pain Research</i>	England	5	2.832
9	<i>European Journal of Integrative Medicine</i>	Germany	5	1.813
10	<i>European Journal of Pain</i>	England	5	3.651

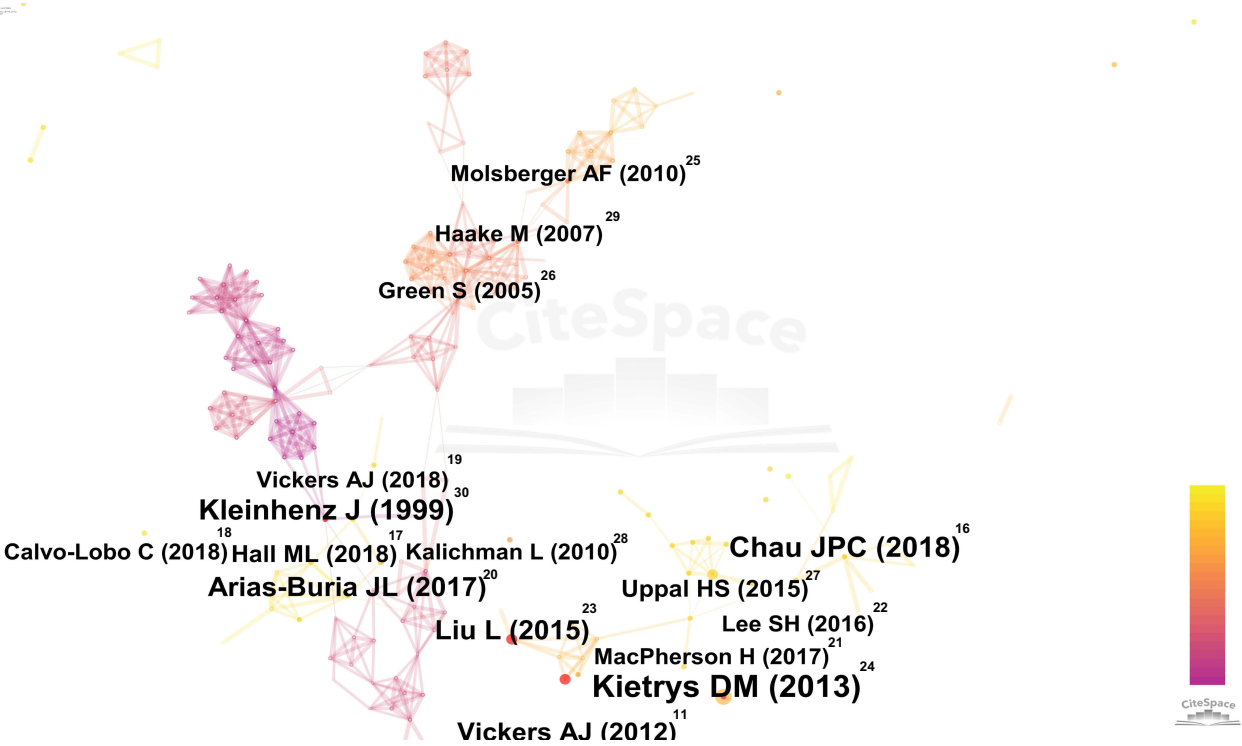


Figure 7 Network map of co-cited references about acupuncture treatment for shoulder pain.

Hotspot Analysis of Research on Acupuncture on Shoulder Pain

Visualization analysis of keywords revealed hotspots and research trends in this research field. Generating a keyword map using CiteSpace resulted in 280 nodes and 766 links (Figure 8). Table 7 shows that the top 10 keywords in terms of frequency were “acupuncture (82)”, “shoulder pain (46)”, “management (36)”, “pain (34)”, “physiotherapy (24)”, “randomized controlled trial (21)”, “dry” “needling (20)”, “trigger point (18)”, “stroke (18)”, and “prevalence (18)”. The top 10 keywords in terms of centrality were “dry needling (0.39)”, “clinical trial (0.37)”, “electroacupuncture (0.31)”, “injection (0.24)”, “corticosteroid injection (0.23)”, “adhesive capsulitis (0.22)”, “fibromyalgia (0.21)”, “physiotherapy (0.18)”, “acupuncture (0.17)”, and “disorder (0.16)”. Taken together, “acupuncture”, “shoulder pain”, “dry needling”,

Table 5 The Top Five References with Co-Citation Frequency

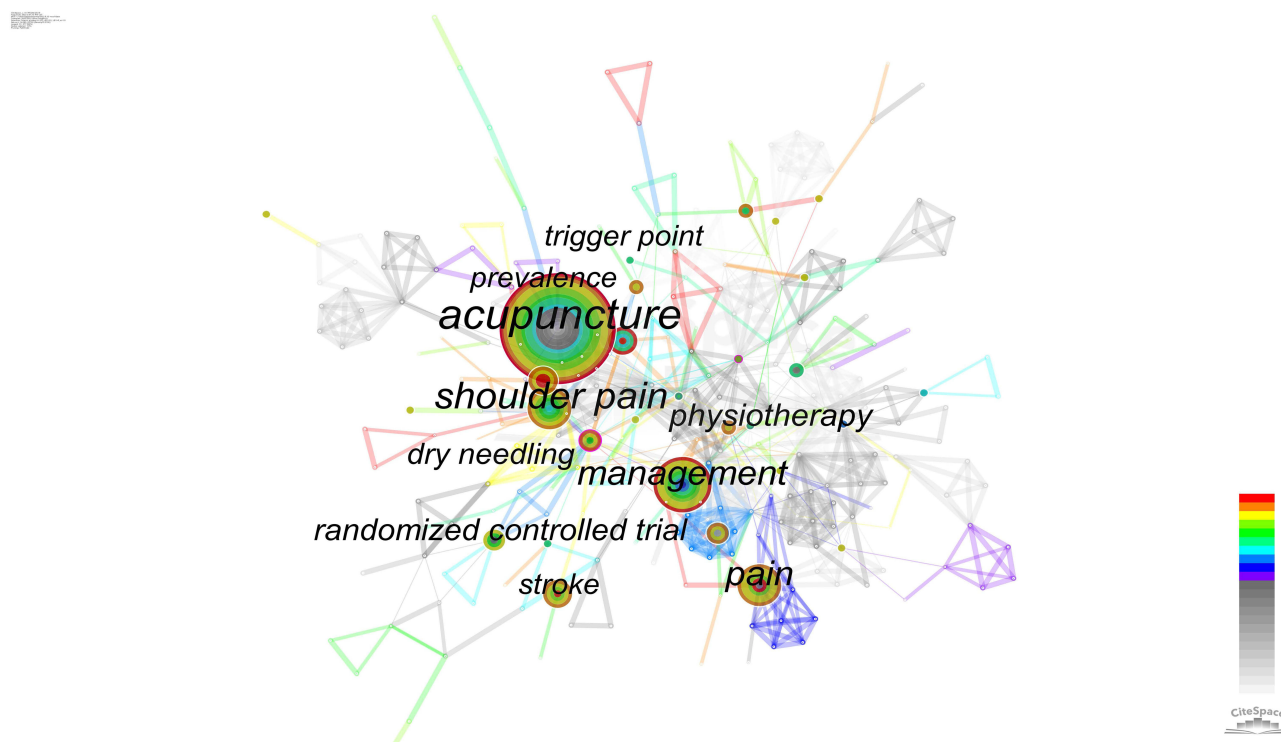
Ranking	Cited Reference	Co-citation Counts	Representative Author (Publication Year)
1	Effectiveness of dry needling for upper-quarter myofascial pain: A systematic review and meta-analysis	12	Kietrys DM (2013) <sup>24</sup>
2	Effects of acupuncture on the recovery outcomes of stroke survivors with shoulder pain: A systematic review	9	Chau JPC (2018) <sup>16</sup>
3	Randomised clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis	9	Kleinhenz J (1999) <sup>30</sup>
4	Effectiveness of dry needling for myofascial trigger points associated with neck and shoulder pain: A systematic review and meta-analysis	8	Liu L (2015) <sup>23</sup>
5	Exercises and dry needling for subacromial pain syndrome: A randomized parallel-group trial	8	Arias-Buría J (2017) <sup>20</sup>

**Table 6** The Top Five References with Co-Citation Centrality

Ranking	Cited Reference	Centrality	Representative author (Publication Year)
1	Acupuncture for shoulder pain	0.07	Green S (2005) <sup>26</sup>
2	Physiotherapy interventions for shoulder pain	0.07	Green S (2003) <sup>14</sup>
3	Corticosteroid injections for shoulder pain	0.07	Buchbinder R(2003) <sup>31</sup>
4	Randomised clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis	0.06	Kleinhenz J (1999) <sup>30</sup>
5	Effectiveness of dry needling for myofascial trigger points associated with neck and shoulder pain: A systematic review and meta-analysis	0.06	Liu L (2015) <sup>23</sup>

“randomized trial”, “injection”, and “randomized controlled trial” were the major hotspots of acupuncture treatment for shoulder pain.

We grouped all the keywords in the publications into 10 clusters: “#0 physiotherapy”, “#1 dry needling”, “#2 corticosteroid injection”, “#3 randomized trial”, “#4 injection”, “#5 electroacupuncture”, “#6 protocol”, “#7 fibromyalgia”, “#8 pain”, and “#9 therapy”, Figure 9 shows different colors. Here’s a timeline showing the evolution of keywords over time (Figure 10); the top 10 cluster words on the horizontal timeline view are on the right of Figure 10, and the left of Figure 10 is the evolution of related keywords from 2000 to 2022. Figure 11 shows the 25 keywords with the most citation bursts in this field, from 2000 to 2022. “Stroke”, “pain”, “shoulder”, “frozen shoulder”, and “manipulation” “stimulation” were related to the research on acupuncture treatment method for shoulder pain and mainly reflects the clinical research on acupuncture treatment of shoulder pain. “Systematic review” and “meta-analysis” represented the same type of research. “Mechanism” was not a high citation burst word but reflected the depth of clinical research in this field.



**Figure 8** Keyword co-occurrence network map. The threshold for node label display in the network is 65, N=280, E= (Density=0.0196), Modularity Q=0.7346, Mean Silhouette=0.9264.

**Table 7** The Top 10 High-Frequency Keywords

Rank	Frequency	Keyword	Rank	Centrality	Keyword
1	82	Acupuncture	1	0.39	Dry needling
2	46	Shoulder pain	2	0.37	Clinical trial
3	36	Management	3	0.31	Electroacupuncture
4	34	Pain	4	0.24	Injection
5	24	Physiotherapy	5	0.23	Corticosteroid injection
6	21	Randomized controlled trial	6	0.22	Adhesive capsulitis
7	20	Dry needling	7	0.21	Fibromyalgia
8	18	Trigger point	8	0.18	Physiotherapy
9	18	Stroke	9	0.17	Acupuncture
10	18	Prevalence	10	0.16	Disorder

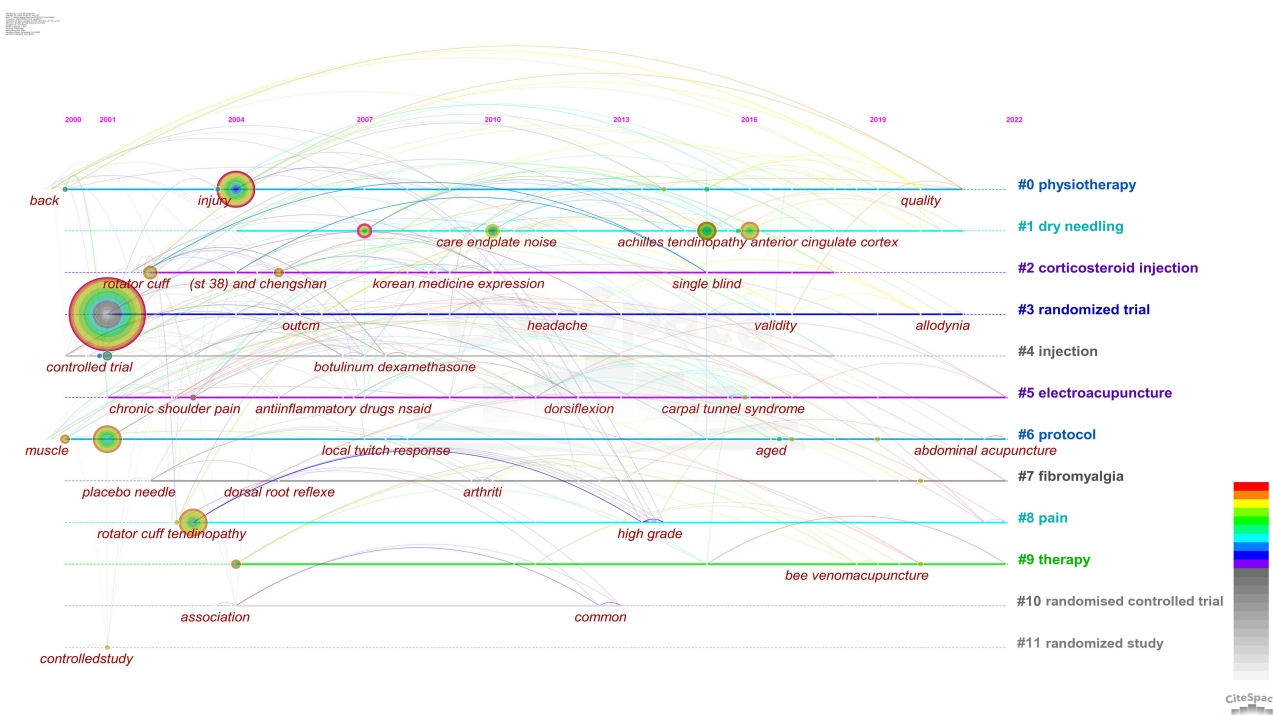
## Discussion

### Outputs of Publications

The total amount of acupuncture treatment for shoulder pain increased significantly, research output in a given field can be analyzed effectively, objectively, and reproducibly for bibliometrics. Depending on the research trend, the domain has been divided into two stages: stage 1, original research is accumulated, and stage 2, with the deepening of research content, the development speed of this field has a more obvious growth rate. Since 2016, some policies of the Chinese government began to benefit the development of TCM,<sup>32–34</sup> which greatly encouraged the enthusiasm of scholars for

**Figure 9** Keywords are classified into 10 clusters.





**Figure 10** Timeline view of the keywords about acupuncture treatment for shoulder pain.

research and creation, and greatly increased the number of TCM publications of Chinese scholars. This is probably the main reason for the rapid growth of Phase 2 articles from China.

## Status of Cooperation

From the [Figure 2](#), One of the most productive developers was Cesar Fernández las Peas (11 publications). A large part of his research team's attention went to studying the effects of dry needling on myofascial trigger point pain after rotator cuff injuries. César Fernández las Peñas's study related to dry needling in the treatment of myofascial trigger point pain after rotator cuff injury was published in the *European Journal of Pain* (5-year impact factor: 4.169).<sup>35</sup> The team of Cunzhi Liu is devoted to the clinical and mechanism of acupuncture-related therapies for shoulder pain, which are related to the brain's electrical activity associated with acupuncture for chronic shoulder pain.<sup>12</sup>

Considering the quantity and centrality of output, China and the US keep them on the leading edge of acupuncture in treating shoulder pain and maintain good cooperative relations with other countries. There are the most references to China, maybe because the land gave birth to acupuncture and moxibustion. In academic communication and cooperation, both of China and the US can achieve mutual benefit and win-win results. Therefore, Chinese and American researchers should remove academic barriers, increase cooperation, and conduct comprehensive research. The three institutions with the most publications were Kyung Hee University (10 publications), Universidad Rey Juan Carlos (8 publications), and China Medical University (8 publications) ([Table 2](#) and [Table 3](#)). According to [Figure 5](#), there is little cooperation between institutions with the most contributions of the top 5, which maybe hold back the development in this field. Hence, it is important to remove academic barriers and calling countries and scholars to strengthen their communication and cooperation.

## Quality and Status of Publications

The journal of the most significant influence is Evidence-based Complementary and Alternative Medicine, with ten publications. The reason why it plays a critical role in this field maybe is that it mainly contains studies on TCM; as acupuncture is a part of TCM, the journal contains many studies on acupuncture treatment for shoulder pain. The Pain

Top 25 Keywords with the Strongest Citation Bursts



Figure 11 The top 25 keywords with the strongest citation bursts about acupuncture treatment for shoulder pain.

was the first in the top 10 of co-citations Journals, with the highest impact factor (7.926). The journal mainly includes studies on pain topics, so it has a large impact, and the impact factor gradually increased over the 5 years; in the publications numbers of journals', the top ten journals' average impact factor is 3.3878. This research field is short of high-influence journal guidance from the journals' average impact factor. In the future, scholars should devote themselves to publishing high-quality articles in high-influence journals.

As shown in Table 5 and Table 6 there were three reviews in the top five cited frequencies, in which the main content was dry needling for the treatment of pain after rotator cuff injury; the studies have found that shoulder pain after rotator cuff injury is mainly related to myofascial trigger points, and pain relief occurs after the inactivation of trigger points at the relevant sites. Wet needling is the injectable substance that includes corticosteroids, anesthetics, sclerosants, botulinum toxins, or other agents injected through the syringe needle.<sup>36</sup> Authors concluded that wet needling is more effective than dry needling in reducing pain after examining research on dry needling for the treatment of shoulder pain.<sup>23</sup> Kleinhenz believes that acupuncture can effectively relieve the symptoms of shoulder pain in athletes but does not sum up the relevant rules of acupoint selection in TCM.<sup>30</sup> There were four reviews in the top five of the literature cited, most of which were about research on wet needling for the treatment of shoulder pain (Table 6). Most studies focused on

the treatment of shoulder pain using dry needling. Treatment with corticosteroid injection was effective for patients with adhesive arthritis; Green S believes that corticosteroid injection is better than physical therapy and has better curative effect.<sup>14</sup> Liu believes that both dry and wet acupuncture can relieve myofascial pain in the short- and medium terms and that the effect of wet acupuncture is better.<sup>23</sup> While Green S believes that there is no evidence to show whether acupuncture is effective in the treatment of shoulder pain, more and better-designed clinical trials are needed to show that short-term pain relief can be achieved.<sup>26</sup>

## Current Research Hotspots and Frontiers

Dry needling is becoming more essential in the treatment of shoulder myofascial pain, as evidenced by the literature review and the hot spot analysis. Furthermore, several meta-analysis studies have revealed that the analgesic effect is better with dry needling.<sup>23</sup> The need to increase quality, for instance, by improving the trial design, has been highlighted by several reviews and studies in this field, which have shown a need for more high-quality RCTs.<sup>37</sup> In recent years, studies on the effectiveness and safety of electroacupuncture for treating shoulder pain have been a research hotspot.<sup>38–40</sup> Even though most studies suggest electroacupuncture can relieve hemiplegic omodynia in patients, taking into account the high bias potential, standardized acupuncture treatment modalities, endpoint assessments, and blinding of treatment are needed for further research.<sup>16</sup> According to specific data, wet needling, also known as point or corticosteroid injections, has been demonstrated to be more effective than dry needling for treating shoulder pain; moreover, some studies have used ultrasound-guided wet needling for the treatment of shoulder pain and reported improved treatment accuracy.<sup>41,42</sup>

As shown in Table 5 and Table 6, “Acupuncture”, “Shoulder pain” were the most frequently used keywords among the top 10 keywords. Most studies, including RCTs and reviews, were related to acupuncture treatment for shoulder pain. Some of these included studies reported that acupuncture is effective in relieving shoulder pain,<sup>43,44</sup> whereas others did not mention whether it is effective or ineffective in treating shoulder pain<sup>26</sup> or whether it is ineffective in treating shoulder pain;<sup>45</sup> Different acupuncture methods or tools have been used in studies on acupuncture to treat shoulder pain, such as bee venom acupuncture,<sup>46</sup> auricular acupuncture,<sup>47</sup> fire needles,<sup>48,49</sup> small needle-knife,<sup>41</sup> thread-embedding acupuncture,<sup>50</sup> warm-needle moxibustion and heat-sensitive moxibustion,<sup>6</sup> electroacupuncture,<sup>51</sup> and sharp-hook acupuncture.<sup>52</sup> Some studies are related to summarizing the common acupoints rules of acupuncture treating and moxibustion in shoulder pain, such as Tiaokou,<sup>53</sup> Chengshan acupoint,<sup>54</sup> Baihui acupoint,<sup>55</sup> Ashi points stimulation;<sup>56</sup> Zhongfu, Tianfu, Xiabai, Binao, Naohui, Jianliao, and Xiaoluo points;<sup>57</sup> distal-needling acupuncture;<sup>58</sup> and acupuncture on the opposite side of the pain to treat long-term shoulder pain.<sup>59</sup> “Dry needling”, “trigger point”, “injection”, and “corticosteroid injection” are included in the top 10 most influential keywords (Table 7). With the rise of myofascial theory, dry or wet needling has emerged to treat myofascial pain in the shoulder. However, many inconsistent and even contradictory experimental results and views have been reported (combined with the above analysis). The author combined clinical experience accumulation and a large number of RCTs to support the point of view that dry needling can be an effective treatment for shoulder pain, and with the application of ultrasound and other instruments, visual manipulation of treatment can be more accurate and safer. “Physiotherapy” was included in the top 10 terms of keyword centrality and frequency. Researchers have compared the effectiveness of physical therapy with acupuncture for shoulder pain;<sup>44,60</sup> Vas J found that the curative effect of combined therapy was better than that of physiotherapy.<sup>61</sup>

Figures 9 and 10 show that “#0 physiotherapy” was the largest cluster term and included many studies on acupuncture, physiotherapy, and other treatments. Studies (meta-analyses) have reported on the effectiveness and safety of acupuncture;<sup>62</sup> “#1 dry needling” was the second most common cluster term. With the development of fascia studies in recent years, many clinical studies have reported on the efficacy or safety of dry/wet needling in the treatment of shoulder pain, as well as the combination of dry needling and other physical therapies for the treatment of shoulder pain or comparison of efficacy.<sup>63,64</sup> Regarding “#3 randomized trial”, many reviews or Meta-studies related to acupuncture for shoulder pain have analyzed many RCTs and reported a lack of high-quality evidence (Table 4); furthermore, many RCTs publish journals with low IF scores or lack of international impact.

The lack of high-quality clinical research on the effectiveness of acupuncture for shoulder pain is also reflected in the prevalence of the terms “Bursts”, “Systematic reviews”, and “Meta-analyses” (Figure 11). From the visualization

analysis of reference co-citation, The many contradictory or inconsistent viewpoints related to the therapeutic effects of acupuncture treat shoulder pain. According to the data since 2018, as the number of publications continues to increase, the frequency of “shoulder”, “pain” and other words gradually increases, which reflects that acupuncture treatment of shoulder periarthritis and poststroke shoulder pain is a research hotspot, especially the combination of acupuncture with active exercise or other physical stimulation.<sup>44,65</sup> The appearance of “Mechanism” reflects that the scholars who have studied deeply have begun to concentrate on the mechanism of acupuncture treatment of shoulder pain, unfortunately, with a few impacts. Currently, acupuncture analgesics have limited research on their mechanism of action. In a study on the mechanism of acupuncture and moxibustion treatment for shoulder pain, Yuan discovered that by combining heat-sensitive moxibustion with warm needling, he could reduce inflammation and discomfort produced by serum inflammatory agents, ease pain, and encourage the recovery of shoulder function.<sup>6</sup> After receiving acupuncture, patients reported considerably less pain catastrophizing, suggesting that the benefit of the therapy was associated to elevated biomarkers.<sup>66</sup> A recent review about that biomedical technology unveiled the mechanisms of acupuncture.<sup>7</sup> In chronic pain conditions, increasing the frequency and strength of acupuncture’s needle stimulation helps improve blood flow to the affected muscles.<sup>67</sup>

## Future Outlook

More high-quality RCTs are needed in the future. It is important to improve evidence-sharing and communication, and adequately investigate and interpret publication bias in quality of clinical practice;<sup>4</sup> explore potential acupuncture and moxibustion patterns or potential acupoints from case reports and ancient literature; and explore the mechanism of shoulder pain through high-quality experimental research. Attention should be paid to the selection of acupoints on different sides, proximal and distal points,<sup>68</sup> and manual acupuncture.<sup>59</sup> Scholars should improve the quality of research and publish more high-quality and influential journals.

## Strengths and Limitations

The study of bibliometrics related to the research progress of acupuncture therapy in shoulder pain is the first-time analysis. We can intuitively learn the most influential authors, countries, and institutions, mapping of cooperation, hotpots, and the trends of frontiers. The study can provide suggestions for hotspot selection and information of potential cooperators with the same research directions for scholars. These suggestions and cooperation information can promote development in this field. The influential references and journals were summarized for researchers, which can help them select high-quality articles related to their research directions.

There are several limitations to this research. To begin, we do not consider databases from the other English Collection or the Chinese Collection except limiting our search to the WoS Core Collection; it will influence the result and lack of persuasion. In addition, we have chosen keywords to search as much as possible, but we may be searching terms that need to be more comprehensive. Last, the discussion of research mechanism depth needs to reinforce.

## Conclusion

Based mainly on CiteSpace, this study provides a reference basis and general direction for research topic selection. With further research, the hotspots and trends can be preliminarily revealed, and future trends and hotspots should focus on studying the mechanism of shoulder pain, improving the quality of clinical research, and conducting related basic research, which will be helpful in optimizing and further developing the subject design.

## Funding

A grant of 2020A1515011421, from the Natural Science Foundation of Guangdong Province provided the study.

## Disclosure

The authors declared there are no interest conflicts to the publication of this study.



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