

Brief Communication

International performance of acupuncture for shoulder pain over more than four decades: a bibliometric study

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Abstract: Purpose: This bibliometric study aims to reveal the current situation, cooperative teams, and future development trends of acupuncture for shoulder pain (SP). Materials and methods: The data source is the Web of Science Core Collection. The software programs used in this study are VOSviewer, Pajek, CiteSpace, Scimago Graphica, and Microsoft Excel. Co-occurrence analysis, descriptive statistical analysis, and burst keywords analysis are applied to analyze paper authors, institutions, countries or regions, keywords, and citations. Results: This study included 350 papers. In the first 30 years since 1976, the number of papers published was very limited. Since 2004, it has shown rapid growth momentum. High-yield countries and institutions were China (92) and Kyung Hee University (18), respectively. In terms of the cooperative relationship, the USA (centrality 0.34) and Beijing University of Chinese Medicine (centrality 0.15) play central roles in the team. The author Macpherson H ranked first with 10 published papers. Evidence Based Complementary and Alternative Medicine (27) has published the most papers. The keywords are grouped into five clusters. The most recent burst keywords include stroke, electroacupuncture, diagnosis, disability, stimulation, mechanism, bee venom acupuncture, and systematic review. Conclusion: In general, the research and international cooperation of acupuncture for SP will continue to emerge. Most of the current studies believe that acupuncture for SP is effective, and more studies will appear to verify its effectiveness. More well-designed trials will be introduced. More classification and detailed treatment methods for SP will be introduced to this research field.

Keywords: Bibliometric analysis, shoulder pain, acupuncture, co-occurrence analysis, burst

Introduction

Shoulder pain (SP) is a common issue in the elderly. The local pain and dysfunction of the shoulder are often caused by aseptic inflammatory stimuli and adhesions from excessive exertion, strenuous exercise, rheumatism, surgery, or stroke, which damage the soft tissues around the shoulder joint, such as the joint capsule, ligaments, bursa, and other structures [1]. SP is often accompanied by neck pain [2]. When the range of motion of the shoulder joint is limited, it is also called frozen shoulder or adhesive capsulitis [3]. About 30% of the working population has SP. Nearly 70% of people have SP in their lives [4]. Nearly half of stroke patients suffer from SP [5].

Acupuncture is a therapy that uses fine metal needles to pierce the body at acupoints and perform manipulation to achieve a therapeutic effect. Acupuncture is used to treat various diseases, especially in the treatment of pain, which is considered to have a very significant effect [6, 7]. Many studies suggest that acupuncture is effective in treating different types of SP, including post-stroke SP, and frozen shoulder [8, 9].

Bibliometrics is a scientific research method that applies mathematical and statistical methods to analyze literature data. It is widely used in various disciplines to study their current situation and development trends, as well as the cooperation teams in a certain field. As far as

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we know, there has been no bibliometric study on acupuncture for SP. Therefore, we conducted this study.

Material and methods

Web of Science (WoS) Core Collection was used as the data source. The search queries were: (TS=(Shoulder Pain) OR TS=(Frozen Shoulder*) OR TS=(Periarthritis of shoulder) OR TS=(periarthritis humeroscapularis) OR TS=(Shoulder Bursitis) OR TS=(Bursitis of Shoulder) OR TS=(fifty shoulder) OR TS=(scapulohumeral periarthritis)) AND (TS=(acupuncture) OR TS=(acupoint*) OR TS=(acupunctur*) OR TS=(*acupuncture)). After a preliminary search of the database, it was found that the first article on acupuncture treatment of SP appeared in 1976. Therefore, the time range was limited to: 1976-01-01 to 2022-10-31. There were no article type, language, and other restrictions. Date searched: November 22, 2022.

CiteSpace, Pajek, and VOSviewer are three popular visual bibliometric analysis software programs used for social network analysis [10-12]. Normally, in the figures they generate, the size of the nodes usually represents the value of the items. The thickness and number of links show the relationships of the items. Scimago Graphics were used in this study for the world distribution map [13].

Results

A total of 350 papers were included in the study. The number of papers varied from 0 to 3 between 1976 and 2003 (**Figure 1A**). Since 2004, it has increased to nine articles every year. Although the number of studies fluctuated from time to time, it showed rapid growth momentum until 2022.

Thirty-five countries or regions published all the papers in this field (**Table 1**). **Figure 1B** and **1C** present the international cooperation relationships of countries or regions. The size of nodes indicates the number of papers published, while the number and thickness of links indicate the intensity of cooperation. The first team is the green cooperation team, including Brazil, Denmark, Japan, Spain, Sweden, Taiwan; The second team is the blue cooperation team, including Australia, England, Ireland, Italy, and the Netherlands. In the cooperation teams, the countries or regions that play key roles are USA,

with a centrality 0.34, China (0.26), Spain (0.20), England (0.13), Australia (0.09), and Canada (0.09) (**Table 1**).

A total of 670 institutions produced all the papers (**Table 1**). From the perspective of cooperative team relationships, the cluster map includes 43 institutions with cooperative relationships that have published three or more papers (**Figure 1D**). There are nine clusters, represented by different colors. The top teams are as follows: the first team is the red cooperation team represented by institutions in South Korea, with close cooperation between institutions. The second team is green, predominantly consisting of institutions in Mainland China and Canada. The cooperation relationships in this team are relatively loose and linear. In terms of the importance of the top team members, Beijing University of Chinese Medicine has the highest centrality with 0.15, followed by Guangzhou University of Chinese Medicine (0.08) and Korea Institute of Oriental Medicine (0.04) (**Table 1**). Institutions from different countries or regions are more inclined to carry out cooperation within their own region.

A total of 1599 authors wrote all the papers. **Table 1** shows the top 10 authors. The top authors are distributed across different countries or regions. Macpherson H, Lewith G, and Foster NE are from England; Lee MS and Shin BC are from South Korea; Vickers AJ and Sherman KJ are from the USA; Linde K and Witt CM are from Germany; and Liu CZ is from China. **Figure 1E** shows the authors' cooperation network. There are seven cooperation teams represented by different colors.

A total of 153 journals published these 350 papers. One hundred and two (accounting for 66.7% of the total) of them are from the Integrative & Complementary Medicine category of SCIE; sixty-three are from the Medicine, General & Internal category; fifty-one are from the Rehabilitation category; forty-nine are from the Clinical Neurology category; and thirty-six are from the Neurosciences category. The top ten journals publishing papers are listed in **Table 2**. Five of them are from the Integrative & Complementary Medicine category in SCI; two are from the Medicine, General & Internal category; two are from the Clinical Neurology category; and one is from the Medicine, Research & Experimental category. According to the Journal Citation Reports (2021) of WoS, the

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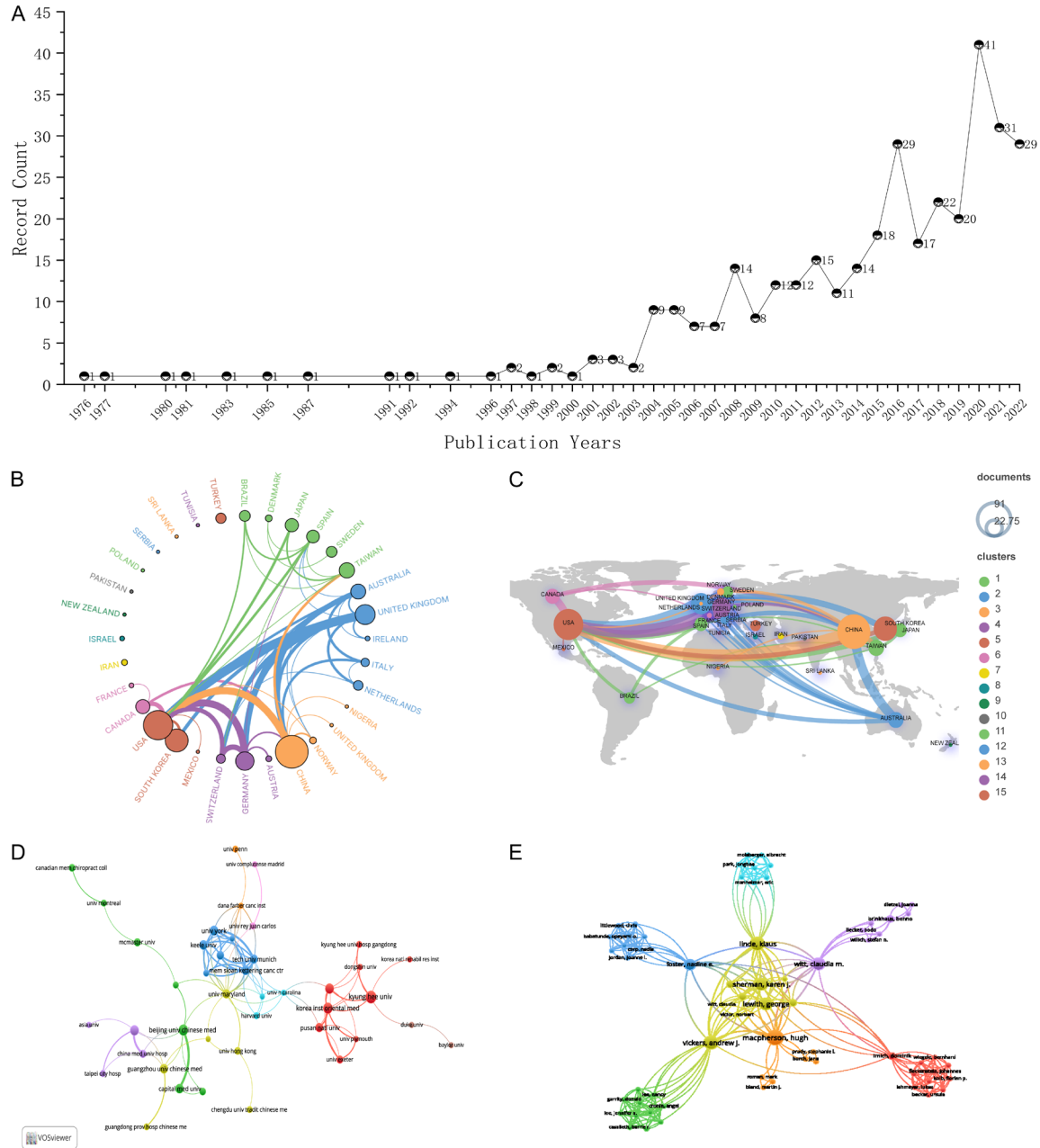


Figure 1. The annual output of published papers and international cooperation of countries or regions, institutions, and authors. A. The Annual Output of Published Papers. B. Clustering Ring Graph of International Cooperation of Countries or Regions. C. World Distribution Map of Countries or Regions. D. Institutional Partnership Map. E. Author Cooperation Network Map.

average impact factor (IF) of the top ten journals is 3.896.

There are 1270 keywords extracted from the papers. A total of 124 keywords with a frequency of five or more are displayed in the cluster map (Figure 2A). There are five clusters represented by different colors. The red one is the largest cluster. The top keywords in this cluster

are: pain (71), physiotherapy (37), shoulder (33), therapy (33), double-blind (30), frozen shoulder (26), exercise (25). The second cluster is green, and the keywords with high frequency are: acupuncture (169), low-back-pain (38), chronic pain (17), randomized controlled-trial (17), neck (16), osteoarthritis (15), tension-type headache (14), meta-analysis (13), randomized-trial (13). The third cluster is blue, and the

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Table 1. Ranking of top 10 countries or regions, institutions, and authors

No	Countries Regions	Count	% of 350	Centrality	Year	Institutions	Abbreviations	Countries regions	Count	Centrality	Year	Authors	Institution	Country	Count	% of 350
1	China	92	26.286	0.26	2007	Kyung Hee University	Kyung Hee Univ	South Korea	18	0.01	2017	Macpherson H	Univ York, N Yorkshire	England	10	2.857
2	USA	76	21.714	0.34	1976	Korea Institute of Oriental Medicine	Korea Inst Oriental Med	South Korea	13	0.04	2009	Lee MS	Korea Inst Oriental Med, Taejon	South Korea	9	2.571
3	South Korea	45	12.857	0.00	2005	Beijing University of Chinese Medicine	Beijing Univ Chinese Med	China	13	0.15	2018	Vickers AJ	Mem Sloan Kettering Canc Ctr, New York	USA	9	2.571
4	England	35	10	0.13	2001	Wonkwang University	Wonkwang Univ	South Korea	11	0.02	2009	Linde K	Tech Univ Munich, Munich	Germany	8	2.286
5	Germany	29	8.286	0.10	1999	China Medical University	China Med Univ	Taiwan, China	11	0.03	2020	Sherman KJ	Grp Hlth Res Inst, Seattle	USA	8	2.286
6	Taiwan, China	20	5.714	0.03	2005	University of York	Univ York	England	10	0.00	2012	Lewith G	Univ Southampton, Hants	England	7	2
7	Australia	19	5.429	0.09	2005	Capital Medical University	Capital Med Univ	China	9	0.00	2018	Shin BC	Pusan Natl Univ, Yangsan	South Korea	7	2
8	Canada	17	4.857	0.09	1977	Keele University	Keele Univ	England	9	0.00	2017	Witt CM	Charite, Berlin	Germany	7	2
9	Japan	15	4.286	0.00	1997	Memorial Sloan Kettering Cancer Center	Mem Sloan Kettering Canc Ctr	USA	9	0.00	2010	Foster NE	Keele Univ, Staffs	England	6	1.714
10	Spain	14	4	0.20	2004	Guangzhou University of Chinese Medicine	Guangzhou Univ Chinese Med	China	9	0.08	2019	Liu CZ	Beijing Univ Chinese Med, Beijing	China	6	1.714

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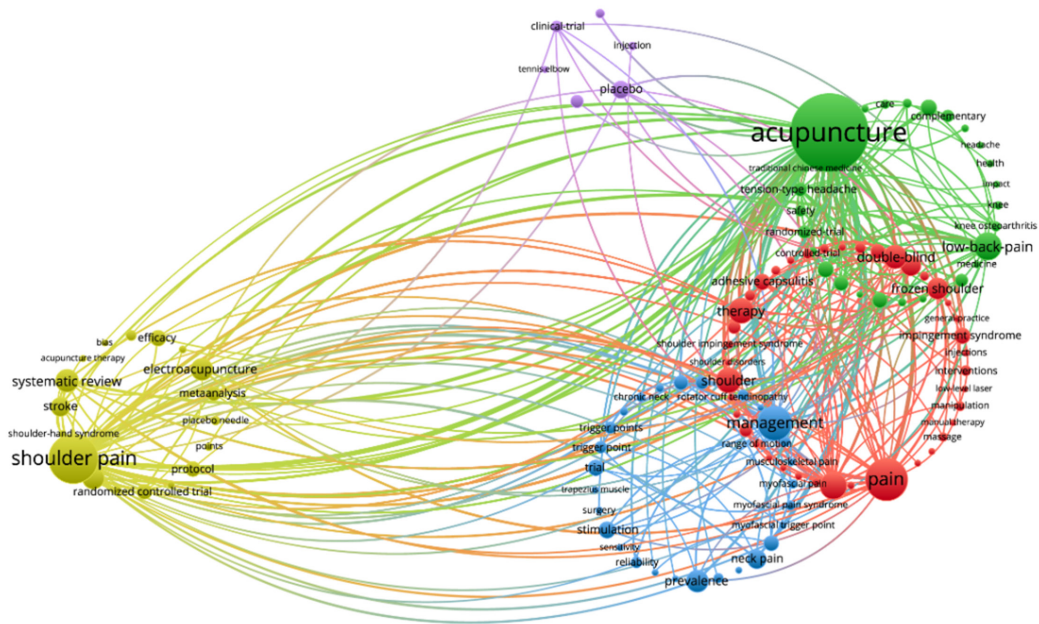
Table 2. Top 10 journals publishing papers and cited papers

No.	Journals	Abbreviations	Count	% of 350	IF*	SCI subject category	Position of WoS	Titles	Authors	Journals	Year	Total citation	Average Citation
1	EVIDENCE BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE	Evid-based Complement Altern Med	27	7.714	2.650	Integrative & Complementary Medicine	16/30	Acupuncture for chronic pain individual patient data meta-analysis	Vickers, Andrew J. et al	ARCHIVES OF INTERNAL MEDICINE	2012	652	59.27
2	MEDICINE	MEDICINE	17	4.857	1.817	Medicine, General & Internal	123/172	The clinical efficacy of Kinesio Tape for shoulder pain: a randomized, double-blinded, clinical trial	Thelen, Mark D. et al	JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY	2008	320	21.33
3	ACUPUNCTURE IN MEDICINE	Acupunct Med	12	3.429	1.984	Integrative & Complementary Medicine	22/30	A meta-analysis of massage therapy research	Moyer, CA et al	PSYCHOLOGICAL BULLETIN	2004	314	16.53
4	COMPLEMENTARY THERAPIES IN MEDICINE	Complement Ther Med	9	2.571	3.335	Integrative & Complementary Medicine	12/30	Acupuncture for shoulder pain	Green, S et al	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	2005	291	16.17
5	PAIN	Pain	9	2.571	7.926	Clinical Neurology Neurosciences Anesthesiology	21/212 33/275 5/34	Acupuncture for chronic pain: update of an individual patient data meta-analysis	Vickers, Andrew J. et al	JOURNAL OF PAIN	2018	282	56.4
6	COCHRANE DATABASE OF SYSTEMATIC REVIEWS	Cochrane DB Syst Rev	7	2	12.008	Medicine, General & Internal	20/172	Needling therapies in the management of myofascial trigger point pain: a systematic review	Cummings, TM et al	ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION	2001	262	11.91
7	JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE	J Altern Complement Med	7	2	2.381	Integrative & Complementary Medicine	20/30	Osteoarthritis: diagnosis and treatment	Sinusas, Keith	AMERICAN FAMILY PHYSICIAN	2012	214	19.45
8	JOURNAL OF MANIPULATIVE AND PHYSIOLOGICAL THERAPEUTICS	J MANIP PHYSIOL THER	7	2	1.300	Health Care Sciences & Services Rehabilitation Integrative & Complementary Medicine	103/109 62/68 27/30	Randomised clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis	Kleinhenz, J et al	PAIN	1999	198	8.25
9	JOURNAL OF PAIN RESEARCH	J Pain Res	7	2	2.832	Clinical Neurology	139/212	Randomized exercise trial of aromatase inhibitor-induced arthralgia in breast cancer survivors	Irwin, Melinda L. et al	JOURNAL OF CLINICAL ONCOLOGY	2015	170	21.25
10	TRIALS	Trials	7	2	2.728	Medicine, Research & Experimental	106/139	Effectiveness of dry needling for upper-quarter myofascial pain: a systematic review and meta-analysis	Kietrys, David M. et al	JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY	2013	169	16.9

Note: *IF according to Journal Citation Reports (2021).

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A



B

No	Keywords	Year	Strength	Begin	End	2002 - 2022
1	efficacy	2008	3.08	2008	2009	
2	knee	2009	2.55	2009	2010	
3	clinical trial	2009	2.41	2009	2010	
4	low back pain	2004	2.64	2010	2012	
5	randomized controlled trial	2004	3.67	2012	2014	
6	acupuncture	2006	1.1	2013	2014	
7	physiotherapy	2011	3.68	2014	2017	
8	exercise	2014	3.07	2014	2015	
9	trigger point	2015	3.52	2015	2016	
10	double blind	2007	3.23	2015	2016	
11	neck	2013	2.44	2015	2016	
12	shoulder impingement syndrome	2015	2.19	2015	2016	
13	myofascial trigger point	2011	1.87	2015	2017	
14	neck pain	2012	1.79	2015	2018	
15	therapy	2004	0.32	2015	2016	
16	subacromial impingement syndrome	2016	1.88	2016	2017	
17	chronic pain	2004	1.86	2017	2018	
18	prevalence	2015	1.63	2017	2019	
19	shoulder	2014	2.01	2018	2020	
20	stroke	2018	1.46	2018	2019	
21	electroacupuncture	2006	0.44	2018	2019	
22	diagnosis	2019	2.33	2019	2020	
23	disability	2015	1.86	2019	2020	
24	stimulation	2007	2.65	2020	2022	
25	mechanism	2020	2.03	2020	2022	
26	bee venom acupuncture	2020	1.79	2020	2022	
27	systematic review	2008	0.53	2020	2022	

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Figure 2. Keywords clustering map and top keywords with the strongest bursts. A. Keywords Clustering Map. B. Top Keywords with the Strongest Bursts.

keywords with high frequency are: management (53), prevalence (28), neck pain (22), stimulation (19), trial (17), myofascial trigger points (16), dry needling (15), electrical nerve-stimulation (13), trigger point (12), trigger points (12). The yellow cluster includes: shoulder pain (87), systematic review (29), electroacupuncture (28), rehabilitation (28), stroke (23), efficacy (17), protocol (16), randomized controlled trial (16), meta-analysis (15).

Figure 2B presents the top 27 keywords with the strongest bursts. The words with the strongest burst strength are: physiotherapy with burst strength 3.68, which appeared in 2011, received more attention from 2014 and continued to 2017; followed by randomized controlled trial 3.67, trigger point 3.52, double blind 3.23, efficacy 3.08, exercise 3.07, simulation 2.65. The most popular burst keywords in the last five years are: stroke, electroacupuncture, diagnosis, disability, stimulation, mechanism, bee venom acupuncture, systematic review. The entire time span of burst keywords is from 2008 to 2022.

A total of 350 papers were cited 9,166 times, and the average number of citations per item is 26.19. The h-index is 49. The top 10 highly cited papers are displayed in **Table 2**. Among them, four papers are meta-analyses about the efficacy of acupuncture and dry needling. The conclusion was that both acupuncture and dry needling have positive results for pain. One meta-analysis was about massage therapy. Three articles are systematic reviews, demonstrating that acupuncture is effective for SP, and it is effective for trigger point pain, respectively and a systematic review of the diagnosis and treatment of osteoarthritis. Three articles are randomized clinical trials, which respectively describe the effect of a special shoulder tape and exercise on SP.

Discussion

The research on acupuncture for shoulder pain (SP) is expected to increase in the future, with China and the USA being the top countries in terms of publication volume and influence in cooperative teams. Kyung Hee University and Korea Institute of Oriental Medicine are the leading institutions, while Beijing University of

Chinese Medicine and Guangzhou University of Chinese Medicine are the key connecting institutions in cooperative teams. China, as the birthplace of acupuncture, has played an important role in the development of acupuncture for SP research worldwide from the perspective of countries, regions, and institutions. From the perspective of the author's analysis, China is a prolific contributor in this field, but there is a lack of Chinese authors with significant international influence, and smaller cooperative teams led by individual authors play a crucial role in connecting the teams. The majority of journals in this field belong to the Integrative & Complementary Medicine category, and while the average impact factor of the top ten journals is relatively low, this suggests that the field has not garnered significant attention from the international community. The keyword research reveals five main clusters related to functional activity limitation of the shoulder joint, chronic pain, trigger points, stroke, and quality of life, psychological problems, with burst keywords appearing in the last 15 years indicating increased attention and current research hotspots. The research on acupuncture for SP lacks strong research in the field, although some studies have shown effectiveness in acupuncture treatment for various diseases, particularly pain-related conditions, despite reservations and ambiguity surrounding its efficacy, and emphasizes the need for proper acupuncture practices to avoid adverse effects. With increasing attention paid to acupuncture by the international community, more trial designs are available for selection. High-quality trial design is also considered the core issue of acupuncture efficacy verification. We believe that future research on acupuncture for SP will further increase.

It must be mentioned that our study has its limitations. The data source of the study is limited to WoS, which leads to a lack of comprehensive research objects. Many scientific papers in other databases have not been included, which cannot fully reflect the research status in this field. Some words are not normalized enough, such as the phrase "Kyung Hee University Hospital" being treated as a different institution from "Kyung Hee University". This would lead to bias in the analysis results. Nevertheless, as the first bibliometric analysis paper on

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acupuncture for SP, this study can provide researchers with a reference for information on overall trends and research hotspots.

Conclusion

From the perspective of research and development direction in this field, the research direction is relatively simple, and the attention received is not enough. The development in the next few years may lead to the refinement of related diseases, diversification of therapies, and improvement of trial design. International cooperation will increase accordingly. The conclusion is that this study provides researchers with an overall picture of acupuncture for SP and a possible future development direction. Researchers can carry out further research in this field based on the current situation and their work.

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Disclosure of conflict of interest

None.

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