REVIEW

A Bibliometric Analysis of Acupuncture Therapy in the Treatment of Musculoskeletal Pain from 2003 to 2022

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Background: Acupuncture therapy has been widely used in the treatment of musculoskeletal pain (MP) in many countries around the world. However, there are no bibliometric studies on acupuncture therapy for MP. Therefore, the aim of this study was to analyze the current status, frontiers and hot spots in the use of acupuncture therapy for the treatment of MP.

Methods: Literature on acupuncture therapy for MP was extracted from the Web of Science Core Collection database from 2003 to 2022. CiteSpace 6.2.R4 (64-bit) software was used to analyze the number and centrality of journals, countries, institutions, authors, references and keywords, and the functions of co-occurrence and clustering were applied to draw a visual knowledge map.

Results: Over the past 20 years, the annual journal publications have been on a steady upward trend, with 438 articles published in 143 journals, including Acupuncture in Medicine Journal published the most (28, 6.39%), JAMA-Journal of the American Medical Association was the journal with the highest impact factor (IF = 120.7003), USA dominated with the most publications (140, 31.96%) among 44 countries, and among 196 research organizations Kyung Hee University was the most prolific (19, 4.34%) and Ha, In-Hyuk was the most published author (9, 2.05%). "Acupuncture" is the most popular and highly sought after keywords. "Low back pain" is the keyword with the highest centrality.

Conclusion: This article provides the current situation of the use of acupuncture therapy in the treatment of MP in the past 20 years, and statistical analysis reveals that "low back pain", "knit osteoporosis" and "break cancer" are new research diseases related to acupuncture therapy for MP, and "myobasic trigger point" is a new research direction of acupuncture therapy for MP. Therefore, this study helps researchers grasp the research hotspots and provide certain references for in-depth research and future topic selection.

Keywords: musculoskeletal pain, acupuncture therapy, bibliometrics, CiteSpace

Introduction

MP refers to pain caused by primary or secondary joints, bones, muscles, tendons and nerves, including common low back pain, neck and shoulder pain, rheumatoid arthritis pain, hip and knee arthritis pain, myofascial pain syndrome and fibromyalgia syndrome, etc., which involves a total of more than 150 disorders of the human locomotor system, and it is the main cause of disability in both developed and developing countries.[1] MP patients suffer from pain for a long period of time, which not only affects the quality of life but also causes serious psychological disorders in patients. As the prevalence of MP is increasing year by year, the treatment of musculos keletal pain has been increasingly emphasized by healthcare professionals. Although advances in medical technology have made the treatment of MP effective, it is still difficult, and 79% of patients are dissatisfied with the effect of pain management.[2]

Data from 2019 show that approximately 1.71 billion people worldwide suffer from musculoskeletal disorders.[3] Pain is the most predominant symptom of musculoskeletal disorders and a major cause of disease burden.[4–8] Nonsteroidal anti-inflammatory drugs (NSAIDs) play an important role in the management of MP, providing effective pain relief and reducing the inflammation associated with such disorders.[9] In the United States, 65% of patients with musculoskeletal pain use NSAIDs to manage their pain.[10] However, the risks associated with oral NSAIDs, such as gastrointestinal injury and cardiovascular disease, limit their potential benefit in many patients.[11,12]

Acupuncture therapy is increasingly becoming a treatment option for patients with MP due to its simplicity of operation and few adverse effects.[13,14] Acupuncture therapy is used to achieve analgesia and promote healthy recovery by stimulating specific acupuncture points.[15] It is estimated that 3 million American adults are treated with acupuncture each year, and musculoskeletal pain is the most common condition treated with acupuncture therapy.[16] Recently, the Centers for Medicare and Medicaid Services agreed to provide acupuncture services to Medicare patients with chronic lower back pain.[17]

Bibliometrics is a discipline that uses mathematical and statistical methods to quantitatively analyze information in the literature. Bibliometrics not only helps to understand the research results in a specific field but also helps researchers to quickly and efficiently grasp the current trends, frontiers and hot spots, so as to guide and determine the future direction of research.[18–22]

CiteSpace is developed by Professor Chen Chaomei, a Chinese-American scholar at Drexel University, based on Java language, to show an analysis software that combines computing technology and visualization technology, mainly based on the theory of co-citation analysis and path-finding network algorithms, etc., through the measurement and analysis of literature in the field of research to explore the key path of evolution of a certain discipline and the turning point, and to predict the current status, progress and dynamic frontiers of research over time in a certain direction or a certain field, and to show them in the form of intuitive and clear maps. By analyzing the literature of a research field, we can explore the key paths and turning points in the evolution of a discipline, predict the research status, progress and dynamic frontiers of a research direction or a field over time, and present them in the form of intuitive and clear maps.[23,24]

To the best of our knowledge, there is no bibliometric analysis of acupuncture therapy for MP. Therefore, the aim of this study was to conduct a bibliometric analysis using CiteSpace to explore the current status, frontiers and hot spots of global research on acupuncture therapy for musculoskeletal pain over the past nearly 20 years, with a view to providing some lessons and references for future research.

Methods
Source of Literature

To avoid omitting of literature searches, we obtained synonyms for "Musculoskeletal Pain" and "Acupuncture Therapy" through PubMed's MeSH database found that synonyms for "Musculoskeletal Pain" include "Musculoskeletal Pains" OR "Pain, Musculoskeletal" OR "Pain. Musculoskeletal" OR "Pains, Musculoskeletal". Entries for "Acupuncture Therapy" include "Acupuncture Treatment", "Acupuncture Treatments", "Treatment, Acupuncture", "Treatment, Pharmacoacupuncture". "Therapy, Acupuncture", "Pharmacoacupuncture Treatment", "Pharmacoacupuncture Therapy", "Therapy, Pharmacoacupuncture", "Acupotomy", "Acupotomies" and several more synonyms were found in our articles. All data collection was conducted on May 27, 2023 by searching all literature published from January 1, 2003 to December 31, 2022 in WOSCC. Searches were not limited to category, language, or type of literature. The search was conducted independently by two authors, Yuqing Wang and Shiqi Xu, and when discrepancies arose they were resolved by Daocheng Zhu and Desheng Wu, resulting in a total of 440 documents (Table 1). After checking with the CiteSpace software, we deleted 2 Meeting Abstracts, resulting in 438 publications for bibliometric analysis (Figure 1). Data deletion was accomplished as a combination of manual validation and CiteSpace software. The Web of Science scientific databases searched were obtained from the Chinese databases in the library of Jiangxi University of Chinese Medicine.

Analysis Tool

Literature exported from WOS selected record content for the full record and cited references, and named download_1-440.txt plain text format, and then imported into CiteSpace 6.2.R4 (64-bit) visualization software, the relevant parameters time slicing

Table 1 Search Queries

Set	Results	Search Query
#1	22,992	TS=(Musculoskeletal Pain OR Musculoskeletal Pains OR Pain, Musculoskeletal OR Pains, Musculoskeletal)
#2	22,669	TS=(Acupuncture Therapy OR Acupuncture Treatment OR Acupuncture Treatments OR Treatment, Acupuncture OR Therapy, Acupuncture OR Pharmacoacupuncture Treatment OR Treatment, Pharmacoacupuncture OR Pharmacoacupuncture Therapy OR Therapy, Pharmacoacupuncture OR Acupotomy OR Acupotomies OR Acupuncture OR Electroacupuncture OR electro-acupuncture OR Acupuncture and moxibustion OR Needle knife OR body Acupuncture OR Needle Acupuncture OR Manual Acupuncture OR Acupuncture point OR Electro-acupuncture OR warm Acupuncture OR Auricular Acupuncture OR Ear Acupuncture OR Moxibustion OR Moxabustion OR acupoint injection OR catgut embedding OR catgut implantation at acupoint OR embedding thread OR moxibustion acupuncture OR fire needling OR fire needle OR fire acupuncture OR Scalp Acupuncture OR Scalp Acupuncture OR Skin Acupuncture)
#3	440	#1 AND #2

set to January 2003 to December 2022, years per slice was set to 1, the research content in node types was selected to be analyzed sequentially, and other parameters in the configuration function area were set according to the system default. The larger the range of nodes in the map indicates that the frequency of the analyzed research objects (or the frequency is cited) is more; the color and thickness in the inner circle of the nodes indicate the frequency of appearance in different time periods; the connecting lines between the nodes indicate the co-occurrence (or co-citation) relationship; the thickness indicates the strength of co-occurrence (or co-citation), and the color corresponds to the time when the nodes were co-occupied for the first time (or co-citation). Purple circles indicate mediator centrality, and nodes with high centrality are considered more important.[25–27]

Results and Discussion

Analysis of the Annual Volume of Publications

The annual volume of publications in the literature is an important indicator for evaluating scientific issues. It can statistically show the development of the field in a chronological change. Guomin Huang and Ziru Li summarized the annual number of publications for different years by applying Microsoft Excel 2022 worksheet and used the charting tool to create a trend line for the annual number of publications. As shown in Figure 2, the study years can be categorized into
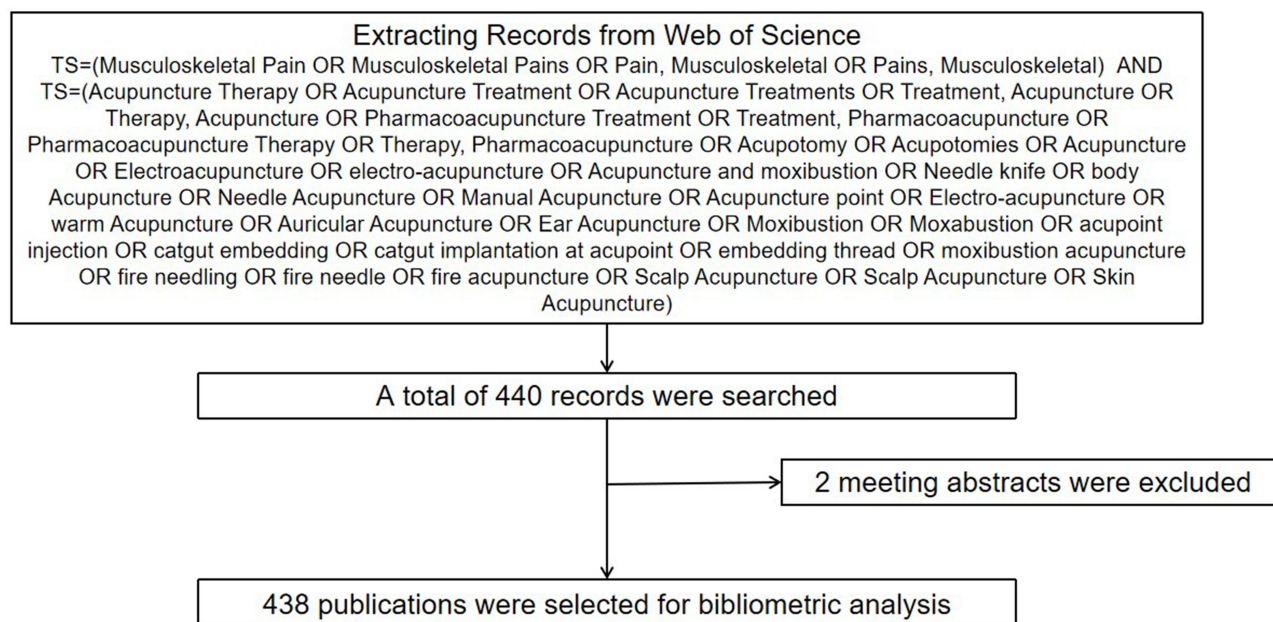
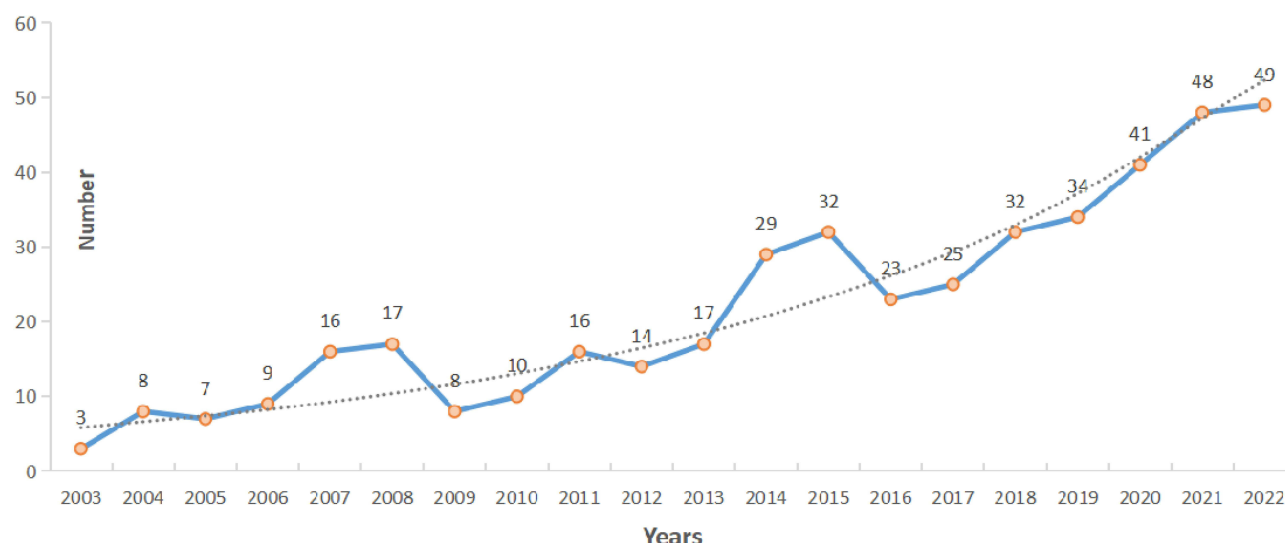**Figure 1** Flow diagram of the included study.

Figure 2 The annual number of publications on acupuncture therapy treatment for MP between 2003 to 2022.

three growth phases: The first phase, 2003–2008, is an exploratory period, with an increase in the literature from 3 to 17; the second phase, 2009–2015, is a developmental period, with an increase in the literature from 8 to 32; and the third phase, 2016–2022, is an accelerated period, with an increase in the literature from 23 to 49. In particular, the third phase enters a new height with an accelerated increase in literature publication, reaching an all-time high of 49 publications per year (10.99%) in 2022. In conclusion, the annual literature publication volume of acupuncture therapy for MP has fluctuated slightly over the past 20 years, but has been on a steady upward trend overall. The findings suggest that MP has received continued attention and focus from researchers, with sufficient developmental momentum to choose acupuncture therapy to treat MP more and more often.

Analysis of Journals and Cited Journals

Out of the 438 documents were categorized into 6 types of literature publication. Article was the most commonly used type of literature with the highest percentage (296, 67.58%), followed by Review (126, 28.77%), Proceedings Paper (9, 2.05%), Letter (3, 0.68%), Editorial Material (2, 0.46%), and Early Access (2, 0.46%) Table 2. Four hundred and thirty-eight Acupuncture Therapy for MP journals were published in 143 magazines, with the highest number of articles published in the Journal of Acupuncture in Medicine Journal (28,6.39%). Journal of Acupuncture in Medicine Journal is an international, peer-reviewed journal that aims to promote scientific understanding of acupuncture and related therapies by publishing scientific investigations of the effectiveness, safety, and mode of action of acupuncture and related therapies, as well as articles reflecting on their application in healthcare delivery and clinical practice. Referring to the Journal Citation Report 2022 of the Institute for Scientific Information, we conclude that among these journals, JAMA-Journal of the American Medical Association has the highest impact factor (IF = 120.7003). JAMA is a comprehensive clinical medical journal sponsored by the American Medical Association. Founded in 1883, JAMA aims to promote the

Table 2 Document Types for Documents Related to Acupuncture Therapy on MP

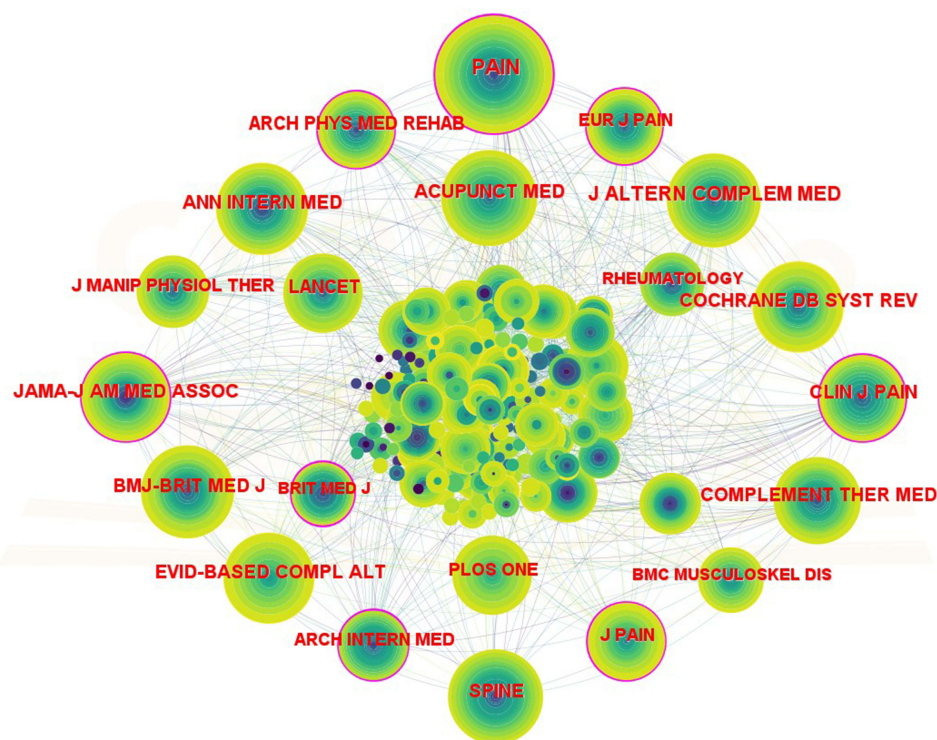| Rank	Type	Counts (%)	Rank	Type	Counts (%)
I	Article	296(67.58)	4	Letter	3(0.68)
2	Review	126(28.77)	5	Editorial Material	2(0.46)
3	Proceedings Paper	9(2.05)	6	Early Access	2(0.46)

Figure 3 Cited journal map related to acupuncture therapy treatment for MP research from 2003 to 2022.

improvement of medical science, medical technology and public health. The journal is advanced, practical, scientific, informative, rich in columns, lively in layout and welcomed by medical workers all over the world.

Combining co-citation and centrality, CiteSpace generated a map of cited journals, including 547 references (Figure 3 and Table 3). The nodes in the map represent journals, and the lines between the nodes indicate co-citation relationships. Different colors in the nodes represent different years. The larger the node area, the higher the number of co-citations.

Table 3 Top 10 Cited Journals and Centrality Related to Acupuncture Therapy on MP

Rank	Cited Journal	Frequency	Rank	Cited Journal	Centrality
1	Pain	270	1	BMJ-British Medical Journal	0.14
2	Journal Of Alternative And Complementary Medicine	188	2	Jama-journal Of The American Medical Association	0.13
3	Acupuncture in Medicine	181	3	Archives of Physical Medicine and Rehabilitation	0.11
4	Spine	173	4	European Journal of Pain Pain	0.11
5	Annals of Internal Medicine	169	5	Anesthesia and Analgesia	0.11
6	BMJ-British Medical Journal	165	6	Archives of internal medicine	0.10
7	Cochrane Database of Systematic Reviews	163	7	Pain	0.09
8	Clinical Journal Of Pain	159	8	Clinical Journal Of Pain	0.09
9	Evidence-based Complementary and Alternative Medicine	158	9	Alternative therapies in health and medicine	0.09
10	Jama-journal Of The American Medical Association	145	10	Journal of Clinical Oncology	0.08

The purple ring indicates centrality, and nodes with high centrality are considered as critical or turning points in the literature. Through Figure 3 and Table 3, it is easy to find that the top journals in terms of frequency and centrality are Pain and BMJ-British Medical Journal, respectively, indicating that the two journals are highly representative and authoritative in the field of research, with high citation rates, which can provide strong evidence to support MP's research. Journal of Pain was founded in 1975, is the official journal of the International Association for the Study of Pain, which involves original research in basic and clinical sciences of multidisciplinary interest, and brings a positive contribution to the study of the nature, mechanisms, and treatment of pain. Journal of BMJ-British Medical was founded in 1840, is one of the world's top medical journals. It is a peer review comprehensive medical journal that is widely welcomed and read around the world, providing practical and professional evidence support for clinicians and scientists in this field, with the distinctive characteristics of rigorous scholarship, novel content, and diverse columns.

Analysis of Countries and Institutions

A distribution map of the country partnership network was generated through CiteSpace, consisting of 44 nodes and 80 connectors (Figure 4), indicating that 438 journals came from 44 countries, with the most journals published in USA (140, 31.96%), followed by South Korea (58, 13.24%), People's Republic of China (54, 12.33%), England (48, 10.96%), followed by Australia (32, 7.31%). The highest centrality was in USA (0.37), followed by Spain (0.19), England (0.14), People's Republic of China (0.12) and Australia (0.12), and the top 10 countries of journal publication and centrality are shown in Table 4. From Figure 4 and Table 4, we know that the USA emphasizes the use of acupuncture therapy for MP treatment, which may be related to the fact that acupuncture therapy is supported by policy, legislation and health insurance in the USA.

As the main place of scientific knowledge research, the distribution of research power in the field of acupuncture therapy for the treatment of MP can be understood by analyzing the published literature from different research institutions. The distribution map of the network of institutional partnerships consisted of 196 nodes and 327 connecting lines (Figure 5), indicating that a total of 196 institutions were dedicated to the research of acupuncture therapy of MP in 438 journals, and the institution with the highest number of publications was Kyung Hee University (21, 4.80%), followed by Korea Institute of Oriental Medicine (KIOM) (16, 3.65%), US Department of Veterans Affairs (12,2.74%), Harvard University (11,2.51%), and
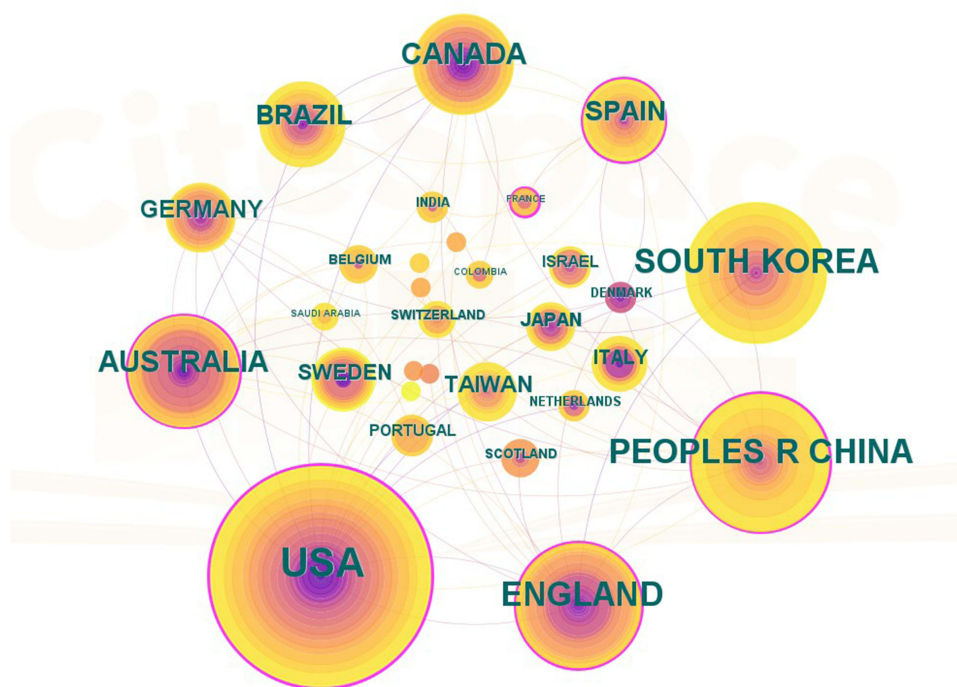

Figure 4 Map of countries researching acupuncture therapy for MP from 2003 to 2022.

Table 4 Top 10 Publications and Centrality of Countries Related to Acupuncture Therapy on MP

Rank	Publications	Countries	Rank	Centrality	Countries
1	140	USA	1	0.37	USA
2	58	South Korea	2	0.19	Spain
3	54	People's Republic of China	3	0.14	England
4	48	England	4	0.12	People's Republic of China
5	32	Australia	5	0.12	Australia
6	29	Canada	6	0.12	France
7	22	Brazil	7	0.07	Canada
8	21	Spain	8	0.07	Germany
9	15	Germany	9	0.06	India
10	12	Taiwan	10	0.02	Switzerland

Veterans Health Administration (VHA) (11, 2.51%). Daejeon University (0.24) had the highest centrality, followed by Korea Institute of Oriental Medicine (KIOM) (0.19), Harvard University (0.19), University of California System (0.19), and University of Exeter (0.19). The top 10 institutions in terms of publication volume and centrality are shown in Table 5. From Figure 5 and Table 5, we can see that institutions from South Korea, the United States and China dominate this field.
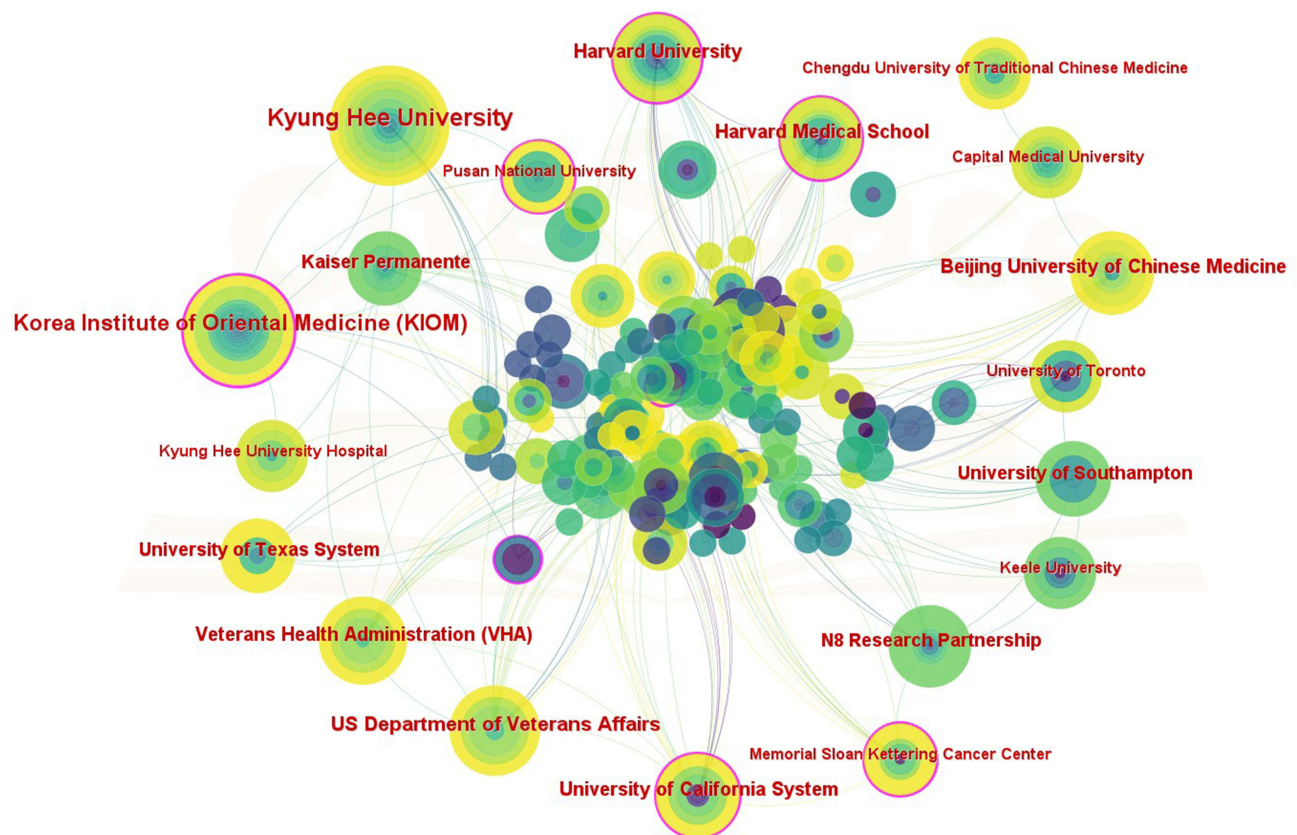

Figure 5 Map of institutions researching acupuncture therapy for MP from 2003 to 2022.

Table 5 Top 10 Publications and Centrality of Institutions Related to Acupuncture Therapy on MP

Rank	Publications	Institutions	Rank	Centrality	Institutions
1	21	Kyung Hee University	1	0.24	Daejeon University
2	16	Korea Institute of Oriental Medicine (KIOM)	2	0.19	Korea Institute of Oriental Medicine (KIOM)
3	12	US Department of Veterans Affairs	3	0.19	Harvard University
4	11	Harvard University	4	0.19	University of California System
5	11	Veterans Health Administration (VHA)	5	0.19	University of Exeter
6	10	Harvard Medical School	6	0.16	Memorial Sloan Kettering Cancer Center
7	10	Beijing University of Chinese Medicine	7	0.15	Harvard Medical School
8	10	University of California System	8	0.12	Kyung Hee University
9	9	N8 Research Partnership	9	0.11	Icahn School of Medicine at Mount Sinai
10	8	University of Texas System	10	0.07	University of Toronto

Research institutions are mainly concentrated in comprehensive universities, universities of traditional Chinese medicine and Health Administration, which may be related to the strong academic resources and strong research atmosphere of universities. At the same time, it also shows that cross-regional cooperation among countries is relatively weak, and there is a lack of cooperation and exchange with external research institutions.
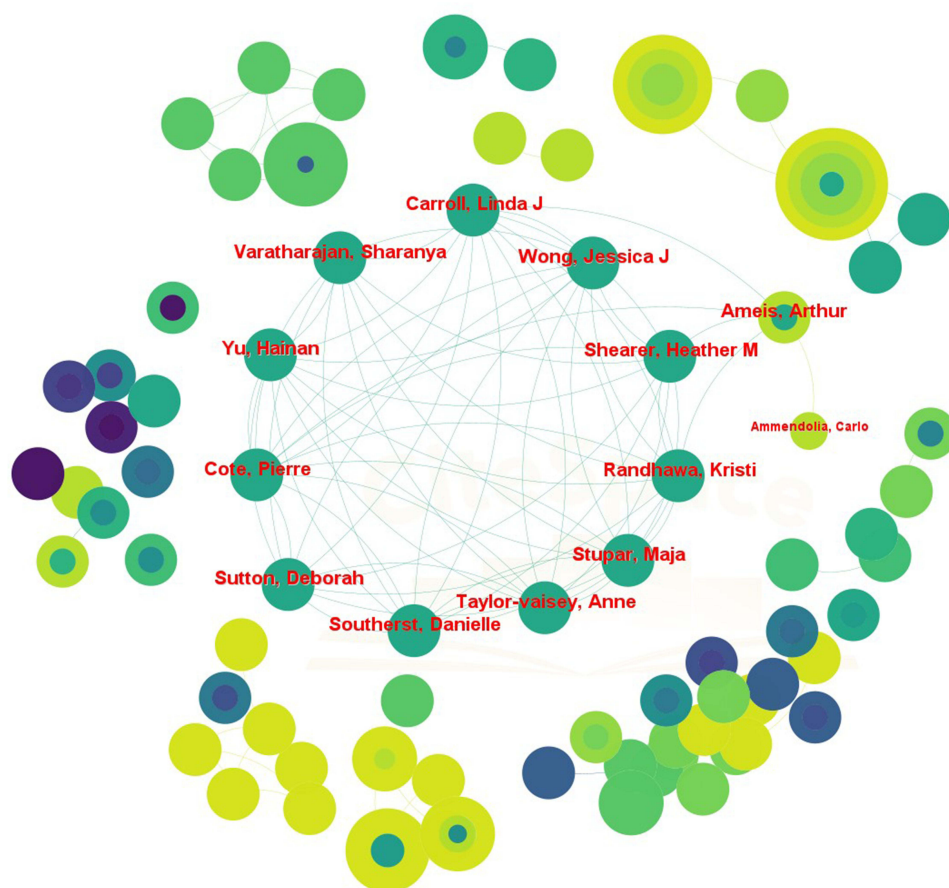

Figure 6 Map of authors related to acupuncture therapy for MP from 2003 to 2022.

Table 6 Top 10 Prolific Authors Related to Acupuncture Therapy on MP

Rank	Publications	Author	Rank	Publications	Author
1	9	Ha, In-Hyuk	6	3	Conboy, Lisa
2	7	Lee, Yoon Jae	7	3	Kim, Jae-Hong
3	5	Mao, Jun J	8	2	Dusek, Jeffery A
4	4	MacPherson, Hugh	9	2	Al-abbadey, Miznah
5	4	Bao, Ting	10	2	Vernon, Howard

Analysis of Authors and Cited Authors

Publishing authors reflect the core authors and their research teams in a research area. Mapping the authors' collaborative relationship network provides both an understanding of the most prolific authors and the extent of collaboration between authors, as well as a way to establish collaborative relationships for researchers. The author collaboration network relationship network graph consists of 438 nodes and 290 connectors (Figure 6). Acupuncture therapy for MP was most published by Ha, In-Hyuk (9, 2.05%), followed by Lee, Yoon Jae (7, 1.60%), Mao, Jun J (5, 1.14%), MacPherson, Hugh (4, 0.91%), and Bao, Ting (4, 0.91%), the top 10 can be seen in Table 6. It is concluded that Ha, In-Hyuk contributes the most and is the most influential in this research field. From Figure 6 and Table 6, we can see that the members of each research team present a strong internal cooperation relationship and a more sparse relationship with other teams, which may be related to the differences in the research direction of each team. If the cooperation between teams can be strengthened, it will make a greater contribution to the advancement and development of the discipline.

Author co-citation analysis can clearly reflect the core authors of a discipline or field, the strength of collaboration among individual authors, and the cross-citation relationship among research literature. The author co-citation network relationship graph consists of 283 nodes and 912 connectors (Figure 7). The most cited author was FURLAN AD (59,13.47%), followed by MACPHERSON H (52,11.87%), ANONYMOUS (50,11.42%), VICKERS AJ (47,10.73%) and ERNST E (46,10.50%). The highest centrality of cited authors were CHERKIN DC (0.39) and FURLAN AD (0.34),
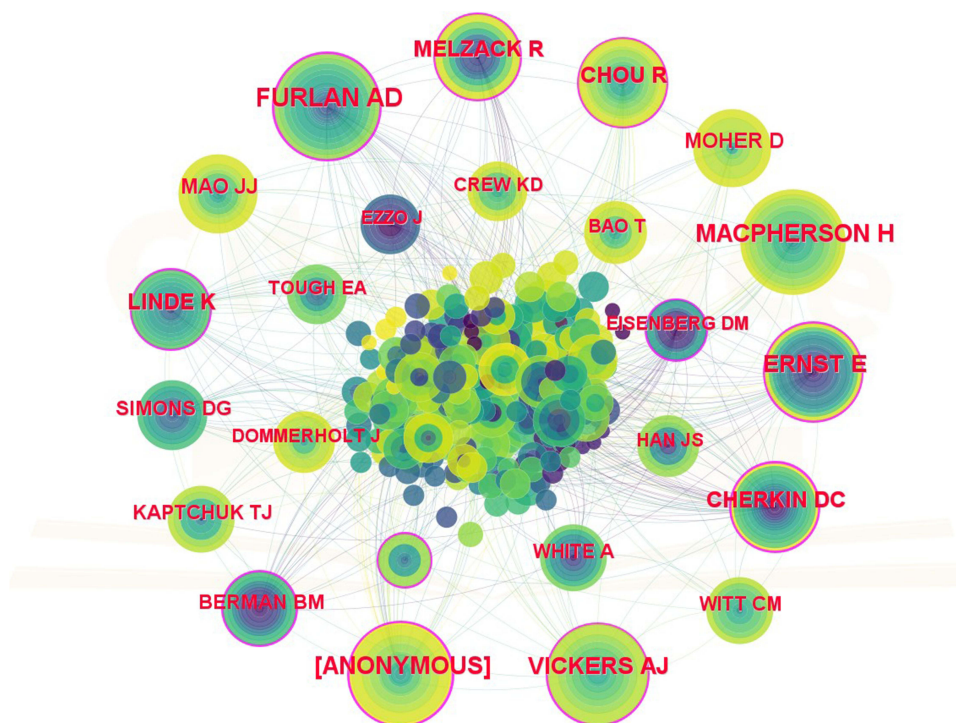

Figure 7 Map of cited authors related to acupuncture therapy for MP from 2003 to 2022.

Table 7 Top 10 Frequency and Centrality of Cited Authors Related to Acupuncture Therapy on MP

Rank	Frequency	Author	Rank	Centrality	Author
1	59	FURLAN AD	1	0.39	CHERKIN DC
2	52	MACPHERSON H	2	0.34	FURLAN AD
3	50	ANONYMOUS	3	0.20	ANONYMOUS
4	47	VICKERS AJ	4	0.19	ERNST E
5	46	ERNST E	5	0.18	LINDE K
6	36	CHOU R	6	0.15	MELZACK R
7	35	CHERKIN DC	7	0.14	CHOU R
8	33	MELZACK R	8	0.12	IRNICH D
9	32	LINDE K	9	0.11	VICKERS AJ
10	30	MAO JJ	10	0.10	EISENBERG DM

followed by ANONYMOUS (0.20), ERNST E (0.19), and LINDE K (0.18), the top 10 rankings of authors in terms of co-citation and centrality are shown in Table 7. Analysis of Figure 7 and Table 7 revealed that FURLAN AD and CHERKIN DC are more active and have conducted more research in this field, which is a good contribution to the development of acupuncture therapy for the treatment of MP.

Analysis of Cited References

Co-occurrence analysis of references provides an understanding of the basic literature in the field and the direction of the most popular topics, as well as facilitating the search for high-quality and highly recognized literature. The literature co-citation graph consists of 278 nodes and 509 links (Figure 8). We ranked the reference co-citation in terms of two dimensions,
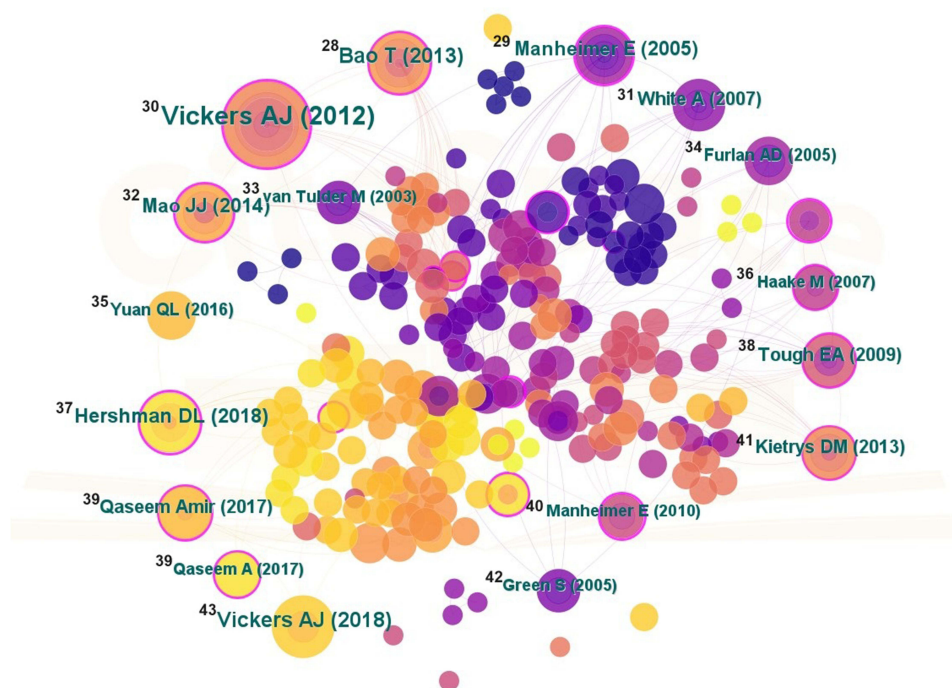
Figure 8 Map of cited references related to acupuncture therapy for MP from 2003 to 2022.

frequency count and centrality, respectively. By counting the number of frequencies, we can determine the level of quality of the literature and the degree of repercussions aroused in the professional field. The top 10 frequency rankings of references are shown in Table 8, we can learn that these literatures are more disseminated and influential in the MP field. Centrality is an index to measure the importance of the position of nodes in the network, which can show the structure and dynamic nature of the field, usually considered that the centrality network node is greater than 0.1 as a key node. The top 10 centrality rankings of references are shown in Table 9, and the centrality of these references is greater than 0.1, which indicates that the literature plays a higher role in the field under study and is more influential.

On the basis of reference co-occurrence analysis, CiteSpace is able to realize automatic extraction of literature and generate cluster identification according to the common relationship of cited literature, so as to clearly get the research focus, and an independent research field with relatively close connection can usually be regarded as a cluster. The likelihood ratio (LLR) algorithm was applied to label the clustering of references (Figure 9). A total of 10 clusters were formed in this study, which to some extent demonstrate the knowledge structure as well as the dynamic change process of

Table 8 Top 10 Frequency of Cited References Related to Acupuncture Therapy on MP

Rank	Frequency	References	Author and Publication Year
1	19	ARCH INTERN MED, V172, P1444. DOI 10.1001/archinternmed.2012.3654[30]	Vickers AJ, 2012
2	10	BREAST CANCER RES TR, V138, P167. DOI 10.1007/s10549-013-2427-z[28]	Bao T, 2013
3	10	J PAIN, V19, P455. DOI 10.1016/j.jpain.2017.11.005[43]	Vickers AJ, 2018
4	9	JAMA-J AM MED ASSOC, V320, P167. DOI 10.1001/jama.2018.8907[37]	Hershman DL, 2018
5	8	ANN INTERN MED, V142, P651. DOI10.7326/0003-4819-142-8-200504190-00014[29]	Manheimer E, 2005
6	8	EUR J CANCER, V50, P267. DOI 10.1016/j.ejca.2013.09.022[32]	Mao JJ, 2014
7	7	RHEUMATOLOGY, V46, P384. DOI 10.1093/rheumatology/kel413[31]	White A, 2007
8	7	EUR J PAIN, V13, P3. DOI 10.1016/j.ejpain.2008.02.006[38]	Tough EA, 2009
9	7	ANN INTERN MED, V166, P514. DOI 10.7326/M16-2367[39]	Qaseem A, 2017
10	7	J ORTHOP SPORT PHYS, V43, P620. DOI 10.2519/jospt.2013.4668[41]	Kietrys DM, 2013

Table 9 Top 10 Centrality of Cited References Related to Acupuncture Therapy on MP

Rank	Centrality	References	Author and Publication Year
1	0.56	ARCH INTERN MED, V172, P1444. DOI 10.1001/archinternmed.2012.3654[30]	Vickers AJ, 2012
2	0.50	JAMA-J AM MED ASSOC, V320, P167. DOI 10.1001/jama.2018.8907[37]	Hershman DL, 2018
3	0.48	EUR J CANCER, V50, P267. DOI 10.1016/j.ejca.2013.09.022[32]	Mao JJ, 2014
4	0.47	COCHRANE DB SYST REV, V0, P0. DOI 10.1002/14651858.CD001977.pub2[40]	Manheimer E, 2010
5	0.45	PAIN, V128, P264. DOI 10.1016/j.pain.2006.12.006[44]	Linde K, 2007
6	0.37	EUR J CANCER CARE, V26, P0. DOI 10.1111/ecc.12457[45]	Chiu HY, 2017
7	0.33	ANN INTERN MED, V166, P514. DOI 10.7326/M16-2367[39]	Qaseem A, 2017
8	0.33	ANN INTERN MED, V166, P493. DOI 10.7326/M16-2459[46]	Chou R, 2017
9	0.32	ANN INTERN MED, V142, P651. DOI10.7326/0003-4819-142-8-200504190-00014[29]	Manheimer E, 2005
10	0.26	BREAST CANCER RES TR, V138, P167. DOI 10.1007/s10549-013-2427-z[28]	Bao T, 2013

Figure 9 Map of co-citation cluster analysis related to acupuncture therapy for MP from 2003 to 2022.

the field. Where the smaller the cluster number, the higher the number of nodes included in the cluster. The results show that the clustering module value Q = 0.841 and the average profile value S = 0.8966. Generally speaking, Q > 0.3 is considered that the delineated clustering structure is significant, S > 0.5 is considered that the clustering is generally reasonable, and S > 0.7 is considered that the clustering has a certain degree of significance and feasibility. The data analysis indicates that the research analysis of acupuncture therapy for MP has a valuable premise and credibility.

Analysis of Keywords

Keywords are the core viewpoints of a paper and a high degree of summarization of the paper's theme, and the co-occurrence analysis of keywords can be used to understand the hotspots and development trends of a particular research field. The keyword visualization analysis of 438 papers generated 288 nodes and 1240 connectivity maps (Figure 10). We found that "acupuncture", "low back pain", "management", "pain", "musculoskeletal pain", "therapy", "prevalence", "randomized controlled trial", "double blind" and "alternative medicine" are the most popular and highly sought after keywords (Table 10). "Burst words" are keywords that have a high number of occurrences in a relatively short period of time or have a high growth rate or are used more frequently. Burst word detection generally includes both intensity and chronological distribution, which can both capture
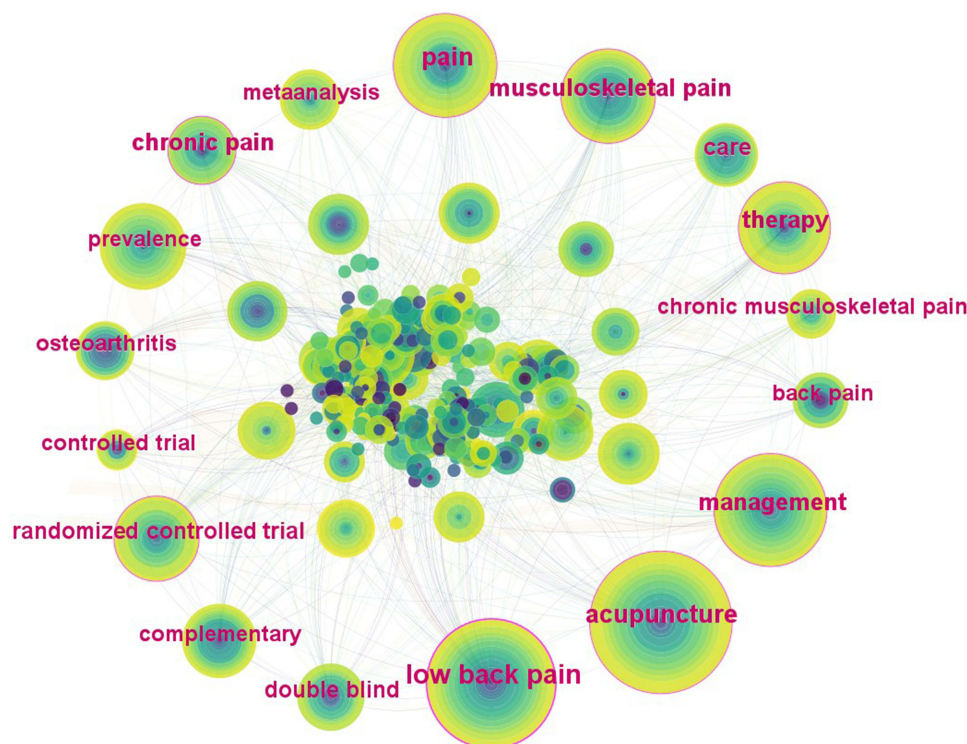
Figure 10 Map of keywords occurrence related to acupuncture therapy for MP from 2003 to 2022.

the research dynamics of the field over time and assist in determining future research hotspots and frontiers. The top 15 keywords with the strongest citation bursts from 2003 to 2022 are shown in Figure 11. Among them, the keywords related to the citation explosion first appeared in 2003. The research hotspots from 2004 to 2017 were "osteoarthritis", "knee", "efficacy", "trial", "united states", "double blind", "care"; 2018 to 2022 research hotspots are "trigger point", "health", "systematic review", "knee osteoarthritis". To sum up, it is not difficult to find that most of the studies on the treatment of MP with acupuncture therapy are carried out in the USA. The diseases are mainly "low back pain" and "knee osteoarthritis", and the research programs are dominated by randomized controlled trial and systematic review. Future studies should adopt double blind and look for more alternative medicine.

Table 10 Top 10 Frequency and Centrality of Keywords Related to Acupuncture Therapy on MP

| Rank	Keyword	Frequency	Rank	Keyword	Centrality
1	Acupuncture	132	1	Low back pain	0.29
2	Low back pain	107	2	Acupuncture	0.19
3	Management	81	3	Pain	0.19
4	Pain	66	4	Musculoskeletal pain	0.19
5	Musculoskeletal pain	56	5	Therapy	0.14
6	Therapy	54	6	Randomized controlled trial	0.14
7	Prevalence	48	7	Management	0.12
8	Randomized controlled trial	44	8	Chronic pain	0.11
9	Double blind	33	9	Care	0.09
10	Alternative medicine	32	10	Double blind	0.08
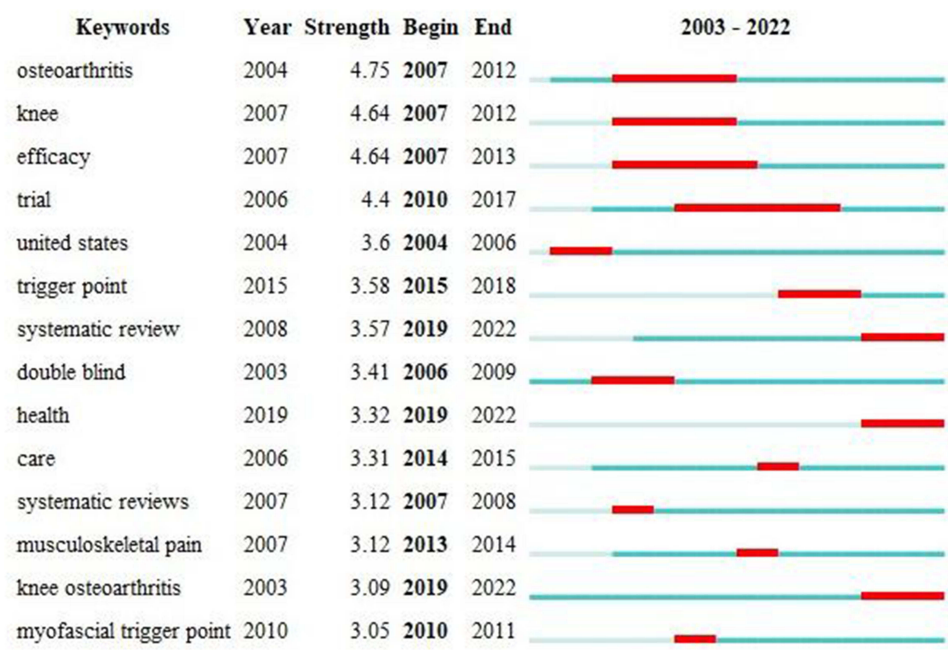
Figure 11 Top 15 keywords with the strongest citation bursts.
Note: The bolded Begin column demonstrated the start year of the keyword.

In addition, in order to observe the changes of keywords in different clusters, the evolution of specific clusters over time needs to be further analyzed, and we produced a visual timeline graph of keyword clusters (Figure 12). Taking the cluster to which the node belongs as the coordinate vertical axis and the publication time (2003–2022) as the coordinate horizontal axis, each node is reasonably distributed in the corresponding position, which can show the time span of the development and evolution of the clusters and the progress of research, and more intuitively show the evolution of research hotspots. Two hundred and eighty-eight keywords were extracted during data collection, and the clustering analysis showed eight clustering results. The clustering module value Q = 0.3265 and the average profile value S = 0.444. It is evident that acupuncture therapy is more feasible for the treatment of MP.

Figure 12 Timeline view of keywords about acupuncture therapy for MP.

Conclusion

In this paper, a series of knowledge maps of acupuncture therapy for MP were drawn using 438 documents in the WOSCC database from 2003 to 2022 as the basic data and bibliometrics and CiteSpace information visualization software as the tools to visualize the current status of research and to predict the future direction of development. The main conclusions are as follows: Although there were small fluctuations in the amount of literature published in the year, the overall situation was in a steady upward trend, and the characteristics of the time phase were prominent, and acupuncture therapy for MP received attention from researchers and showed a strong development momentum. Four hundred and thirty-eight documents were published in 143 journals, which journal of Acupuncture in Medicine had the highest publication volume, JAMA-Journal of the American Medical Association was the journal with the highest impact factor (IF = 120.7003), the USA had the dominant publication volume, Kyung Hee University was the most prolific research institution, and Ha, In-Hyuk was the most published paper most authors. "Low back pain", "knee osteoarthritis", and "breast cancer" are emerging research categories associated with acupuncture therapy for MP. "Myofascial trigger point" is an emerging research direction for acupuncture for MP. Of course, we also found that there is not much collaboration among research institutions, most of which publish independently, and there is relatively weak collaboration across international regions and lack of collaboration and exchange with external research institutions. The researchers present a strong internal cooperation relationship, while the relationship with other teams is more sparse, and the frequency and intensity of cross-team cooperation is weak.

After 20 years of development, academic research on the treatment of MP with acupuncture therapy has achieved relatively fruitful results and developed theoretical methods and practical experience that are worthy of reference, but there are still many unresolved scientific issues in the existing research. Future research on acupuncture therapy for MP can be deepened in the following aspects. First, strengthening the sense of cooperation between research institutions and authors to improve the output of research results. Research institutions and scholars from different backgrounds should carry out deeper exchanges and cooperation across regions, countries, institutions, teams, disciplines, and specialties, so as to open up new research horizons through "collision of ideas".[24,70–72] Secondly, scientific and standardized research methods should be carried out to improve the quality and level of research. Clinical trials should follow the gold standard of randomized, controlled, blinded, and repetitive design, overcome subjective bias as much as possible, and explore multi-center, multi-perspective, multi-method, multi-level, and multi-dimensionally, to fully confirm the advantages of acupuncture in treating MP, and to better serve the patients.[73–76]

In summary, this paper analyzes the evolution of acupuncture therapy for MP research, which helps to clearly show the overall situation of acupuncture therapy for MP, with a view to providing certain reference value for in-depth research and future selection of topics in this field. Of course, CiteSpace software has more data analysis functions, which are not all used in this paper, and it is worthwhile to conduct in-depth research in the future.

Data Sharing Statement

Raw data can be directly obtained from the Web of Science Core Collection (WoSCC).

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be responsible for all aspects of the work.

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