

Research Trends of Acupuncture Therapy on Myofascial Pain Syndrome from 2000 to 2022: A Bibliometric Analysis

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Background: Acupuncture has been widely used to relieve myofascial pain syndromes (MPS) in many countries. However, the bibliometric analysis of the global application of acupuncture for MPS remains unknown.

Purpose: The present study aims to evaluate the research trends and hot spots of acupuncture for MPS.

Methods: Literatures about acupuncture for MPS from 2000 to 2022 were obtained from the Web of Science. CiteSpace (6.1.R3) was used to analyze the number of publications, countries, institutions, authors, cited journals, cited authors, cited references and keywords.

Results: A total of 403 records were included in the final analysis. The total number of publications increased but with some fluctuations. The *Pain* was the most cited journals. The most productive country and institution were USA, and China Medicine University, respectively. Liwei Chou was the most prolific author, and Simons DG ranked first in the cited author. In the ranking of frequency and centrality in cited references, the first article was published by Tough EA and Simons DG, respectively. The keyword of "acupuncture" ranked first in frequency, "double blind" ranked first in centrality. "Meta-analysis" was the keyword with the strongest citation burst. There were three hot topics in this field, including "the clinical feature of MPS", "measure of intervention" and "research method". The mechanism of acupuncture on MPS was one of the main research directions.

Conclusion: This study reveals that acupuncture was more and more acceptable, while the cooperation between different countries, institutions and authors should be strengthened. The researches of therapeutic effect and mechanism were the main research directions. More high-quality clinical trials are needed to confirm the therapeutic effect of acupuncture for MPS, and more studies to unify the acupuncture parameters such as frequency, duration, and intensity. More basic studies are needed to elucidate the precise mechanism of acupuncture for MPS.

Keywords: acupuncture, myofascial pain syndromes, bibliometric analysis, CiteSpace

Introduction

Myofascial Pain Syndrome (MPS) is considered as one of the most common chronic musculoskeletal pain syndromes.¹ In pain clinics, the prevalence of MPS may reach highly up to 85%.² MPS is always characterized by the presence of myofascial trigger points (MTrPs). A MTrP is defined as a specific sensitive zone or point, tender region or a taut band contained in the skeletal muscle fibers, which produces the significant pain as well as motor dysfunction of the muscle.^{3,4} Additionally, MPS is often associated with anxiety and depression.⁵⁻⁷ The existence of MTrPs always seriously reduce the patients' quality of life.

The goal of MPS treatment is pain relief. Nonsteroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants are commonly used on patients with MPS.⁸ However, there is not enough evidence to determine if they are effective and they always tend to cause gastrointestinal discomfort and drowsiness.^{9,10} Some studies reveal that extracorporeal shockwave,

low power laser and therapeutic ultrasound can be used for MPS.^{11,12} The evidences of these therapies' beneficial effect remain inconclusive. Acupuncture and dry needling are more and more recognized as effective treatments with minimal side effects for MPS.^{2,13–16} However dry needling is similar to acupuncture and frequently is regarded as a form of acupuncture.¹⁷ During the past decades, clinical and scientific interest in acupuncture for MPS has grown significantly. Some clinical trials and systematic reviews showed that acupuncture could significantly relieve pain and reduce irritability of MPS.^{18–21} While the exact mechanism of acupuncture or dry needling for MPS is not unraveled nowadays. The mechanism researches mainly focus on the peripheral and central aspects. Researches revealed that acupuncture could inhibit pain transmission by decreasing SP and increasing endogenous opioids.^{14,22} A recent research suggested that dry needling improved strength, functionality and locomotor activity in a rat model of muscle pain syndromes by inducing an antioxidant effect.²³ Another research showed that the needling on trigger point changed the gene expression of muscle tissue to accelerate the muscular regeneration.²⁴ As for the central aspect, some scholars supported that acupuncture could activate the supraspinal and higher centres involved in pain processing.²⁵ In contrast, some researchers argued that there was no significant difference between acupuncture and placebo acupuncture for treating MPS.²⁶

There are many studies on the curative effect and mechanism of acupuncture treatment for MPS. However, to the best of our knowledge, a bibliometric analysis of the use of acupuncture for MPS has not yet been performed. Therefore, the present study aims to evaluate the research trends and hot spots of acupuncture treatment on MPS within the past 23 years (from 2000 to 2022) through bibliometric analysis by using CiteSpace. CiteSpace is a widely used visualization tool invented by Professor Chaomei Chen, which can produce co-occurrence network maps of countries, institutions, authors, keywords and co-citation network of cited journals, cited authors, cited references through a series of mathematical tools.^{27–29}

Methods

Data Collection

Literatures were obtained from the Science Citation Index Expanded (SCI-expanded) of the Web of Science (WoS) Core Collection database. To prevent the omission of searching the literature, we obtained the synonyms for “myofascial pain syndrome” and “acupuncture” through the Medical Subject Heading (MeSH) Database in PubMed. The data search strategy included the topic “myofascial pain syndrome” and “acupuncture”. The publication period of the literature ranged from January 1, 2000 to June 30, 2022. Specific search strategies and results are shown in Table 1. There were no restrictions on language, categories or document types. A total of 405 references were acquired, while 403 references were used for bibliometrics analysis after CiteSpace removed duplication.

Analysis Tool

Bibliometric analysis was performed by CiteSpace (6.1.R3) software, which is an excellent scientific econometric analysis software based on the Java platform for analyzing and visualizing network.³⁰ It can be used to analyze the annual output counts, the prolific authors, journals, institutions and countries. It also can be used to explore the co-occurrence relationships of countries, institutions, authors and keywords, and the co-citation relationships of authors, journals and references.

Table 1 The Topic Search Query

Set	Results	Search Query
#1	19,544	(TS=(Acupuncture) OR (Acupuncture Therapy) OR (Acupuncture Treatments) OR (Acupuncture Points) OR (Manual Acupuncture) OR (Needle Acupuncture) OR (body acupuncture) OR (Acupuncture, Ear) OR (Acupuncture Analgesia) OR (Auricular Acupuncture) OR (Electroacupuncture) OR (electro-acupuncture) OR (Warm Acupuncture) OR (Moxibustion)) Indexes=Web of Science, Timespan=2000–2022
#2	22,640	(TS=(trigger point) OR (Myofascial Pain Syndrome)) Indexes=Web of Science, Timespan=2000–2022
#3	405	#1 AND #2

The parameters of CiteSpace were set as follows: time slicing (2000–2022), years per slice (1), pruning (pathfinder). Visualization knowledge maps consist of nodes and links. Different nodes in the map represent different elements such as author, keyword, institution, country, etc. Links between the nodes signified relationships of cooperation or cooccurrence or co-citation. A larger size of the node represents a high frequency of publications and a larger width of the link indicates stronger co-operation/co-occurrence/co-citation. The color of nodes and lines represents different years. The purple circle represents centrality. Nodes with high centrality usually mean turning points or pivotal points in a specific field.^{31,32}

Results and Discussion

Annual Publication

A total of 403 publications were included by searching the SCI-expanded database from 2000 to 2022 using the aforementioned search strategy. The annual number of publications is presented in Figure 1. There was a small number of articles published before 2004. The number of publications continued to increase to 16 from 2004 to 2008. There was a slight decrease in 2009. From 2009 to 2012, the number slowly increased to 22. But it was suddenly decreased to 15 in 2013. While from 2013 to 2015, the number increased rapidly and continually, reaching a peak of 36. It decreased in 2016 and then increased slowly from 2017 to 2020. The number slightly dropped to 28 in 2021. Additionally, given that we performed the search on June 30, 2022, the total number of retrieved publications in 2022 cannot reflect the publication of the whole year. In summary, the total number increased over the past 23 years but with some fluctuations. The results indicate that more acupuncture researches on MPS were performed and acupuncture, as a complementary and alternative treatment, is receiving more attention.

Analysis of Documents Type

Four document types were identified in the total of 403 records. Articles (259) were the most frequently used document type, accounting for 64.27% of the total records. They are followed by reviews (105, 26.05%), letter (8, 2%) and editorial material (4, 1%; Table 2).

Analysis of Cited Journals

The cited journal map was generated by CiteSpace, which resulted in 549 nodes and 2949 links (Figure 2). The Journal of *Pain* ranked first in the frequency of cited journals, followed by *Arch Phys Med Rehab* and *Acupunct Med* (Table 3). The Journal of *AM J Chinese Med* ranked first in the centrality, followed by *Anesth Analg* and *Neurosci Lett* (Table 3). In the journal cited in 294 records of *Pain*, one article got largest citations, which performed a meta-analysis of acupuncture

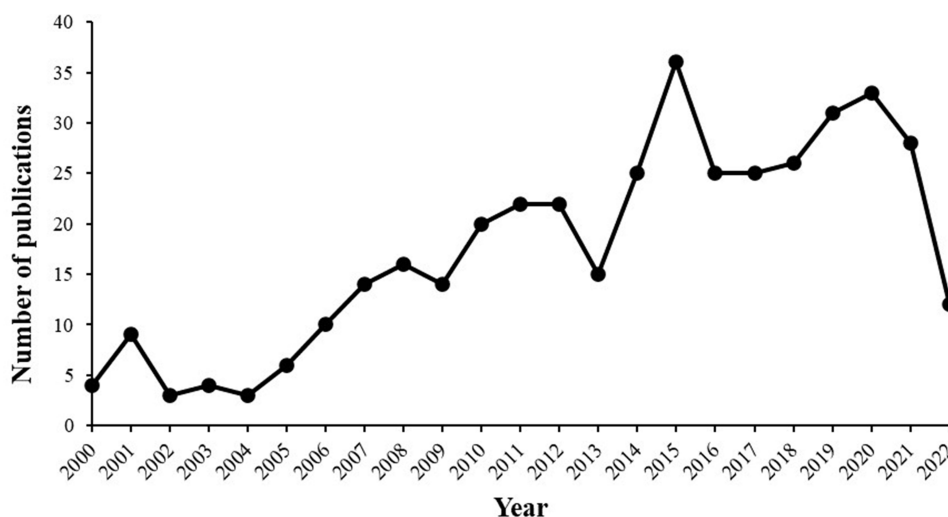


Figure 1 The annual number of publications on acupuncture for MPS from 2000 to 2022.

Table 2 Document Types for Documents Referencing Acupuncture for MPS

Ranking	Type	Counts (%)
1	Article	259 (64.27%)
2	Review	105 (26.05%)
3	Letter	8 (2%)
4	Editorial Material	4 (1%)

for four chronic pain conditions and supported that acupuncture was effective and was more than a placebo for the treatment of chronic pain, including MPS. The meta-analysis provided robust evidence that acupuncture was a reasonable referral option for patients with chronic pain.³³ While in the highest centrality of *AM J Chinese Med*, the article which got largest citations was a guideline for the management of chronic nonspecific low back pain, and it did not recommend acupuncture for the treatment of chronic low back pain, because of that there was conflicting and limited evidence that acupuncture was better than a sham procedure or standard treatment such as exercise, NSAIDs.³⁴ Some conditions of chronic nonspecific low back pain belong to MPS in clinical.³⁵ More high-quality clinical trials are needed in the future researches to further confirm the efficacy of acupuncture on MPS.

Analysis of Country and Institution

The merged network of countries/regions comprised 46 nodes and 109 links (Figure 3), indicating that the 403 references were published by researchers in 46 countries/regions. As shown in Table 4, the top 5 countries/regions of publications were USA (90), Peoples R China (71), Spain (45), Taiwan (34) and England (28). The top 5 countries/regions for centrality (purple ring) were USA (0.25), England (0.23), Germany (0.20), Spain (0.15) and Peoples R China (0.12). China was one of the important countries on researching acupuncture for MPS, maybe because of that acupuncture originated from China. USA, England, Spain, Germany are all developed countries, which means that acupuncture was popular in developed countries. Interestingly, USA was first both of publications and centrality, which indicated the much attention on acupuncture treatment for MPS in USA. Further analysis from the citations revealed that more meta-analysis of randomized controlled trials (RCTs) of acupuncture therapy on MPS were being performed. Most of the meta-analysis indicated that acupuncture was beneficial for MPS and the acupuncture was more than a placebo.^{21,35,36} However,

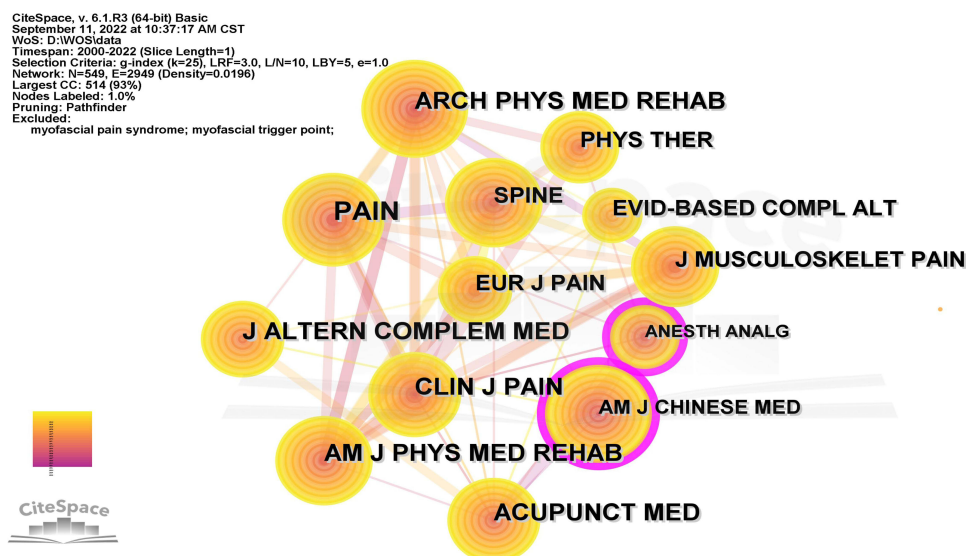


Figure 2 Cited journal maps of acupuncture on MPS from 2000 to 2022. The nodes in the map represent journals, and the lines between the nodes mean co-citation relationships. The different colors of the nodes represent the different years. The larger the node area, the greater the number of co-citations. The purple ring represents centrality, and nodes with high centrality are considered as pivotal points in the publications.

Table 3 Top 10 Cited Journals Related to Acupuncture on MPS

Rank	Frequency	Cited Journal	Centrality	Cited Journal
1	294	Pain	0.15	AM J Chinese Med
2	239	Arch Phys Med Rehab	0.11	Anesth Analg
3	220	Acupunct Med	0.08	Neurosci Lett
4	181	Clin J Pain	0.08	Acupuncture Electro
5	181	Am J Phys Med Rehab	0.08	Brain Res
6	151	J Altern Complem Med	0.06	Phys Ther
7	148	Spine	0.06	Lancet
8	140	Eur J Pain	0.06	J Electromyogr Kines
9	132	J Musculoskelet Pain	0.05	Complement Ther Med
10	123	Evid-based Compl Alt	0.05	BMJ-Brit Med J

additional well-designed studies are needed to support the recommendation due to the small number of high-quality RCTs published to date according to a meta-analysis.²¹

The map of institutions consisted of 412 nodes and 471 links (Figure 4). The 403 publications were distributed among 412 research institutions. The top five institutions of publications were China Medicine University (22), Universidad of Rey Juan Carlos (11), Hungkuang University (10), Harvard University (8) and Chengdu University of Traditional Chinese Medicine (7) (Table 5). There were three institutions among the top five institutions of publications in China, which indicated that China was an important country on researching acupuncture for MPS. Further analysis indicated that the main research direction of China Medicine University was the remote effect of acupuncture on the irritability of MTrPs and the spinal cord mechanism.^{37–39} The centralities of all institutions were low. The institutions of China Medicine University and Hungkuang University had the strongest cooperation, while cooperation among other institutions should be further strengthened.

Analysis of Author and Cited Author

Distribution of authors map consisted of 497 nodes and 684 links (Figure 5). Table 6 shows the top ten authors who have published articles related to acupuncture for MPS. Liwei Chou was the most productive author who have published 14 articles, followed by Changzern Hong (13), Cesar Fernandezdelaspenas (11) and Yuehling Hsieh (9). Among the ten authors, Liwei Chou, Changzern Hong, Yuehling Hsieh and Chenchia Yang all came from Taiwan and had close

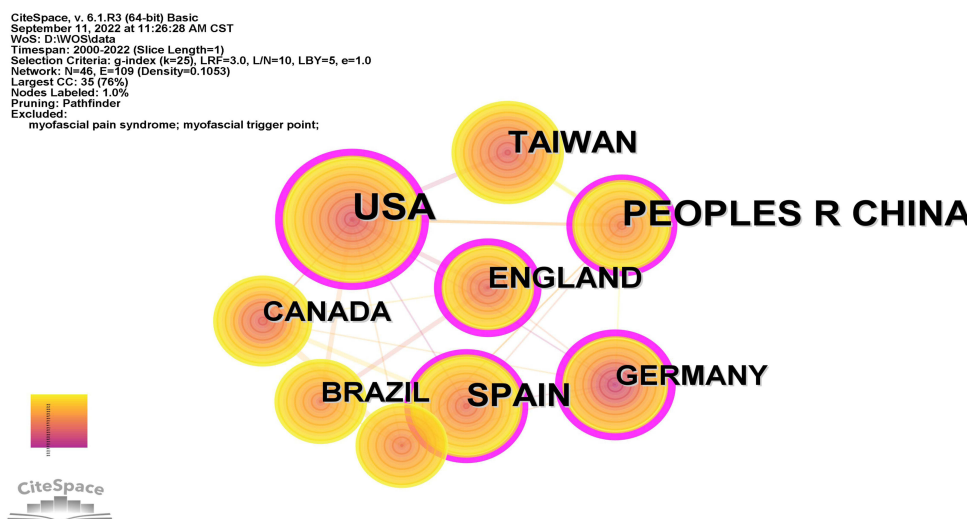


Figure 3 Map of countries/regions researching acupuncture on MPS from 2000 to 2022. The nodes in the map represent countries or territories. The lines between the nodes means cooperation relationships. The different colors of the nodes represent the different years. The larger the node area, the larger the number of publications. The purple ring represents centrality, and nodes with high centrality are considered as pivotal points in the literature.

Table 4 Top 10 Publications and Centrality of Countries/Regions Related to Acupuncture on MPS

Rank	Publications	Countries	Centrality	Countries
1	90	USA	0.25	USA
2	71	Peoples R China	0.23	England
3	45	Spain	0.20	Germany
4	34	Taiwan	0.15	Spain
5	28	England	0.12	Peoples R China

cooperation with each other on the remote effects and mechanism of dry needling at myofascial trigger points.^{22,38,40,41} Their researches revealed that acupuncture had remote effectiveness on suppressing the myofascial trigger point irritability and this effect may be related to the normal spinal cord function, interactions within the endogenous opioid system and biochemicals associated with pain, inflammation, and hypoxia. The links showed that the cooperation between authors in this field was not close. Moreover, the centrality for each collaboration was 0, suggesting that collaboration between research authors should be further strengthened.

The map of cited authors consisted of 683 nodes and 2786 links (Figure 6). The top five frequency and centrality of cited authors are shown in Table 7. In terms of co-citation counts, Simons DG (151) ranked first, followed by Hong CZ (119), Melzack R (97), Tough EA (94) and Dommerholt J (79). The top five centrality of cited authors were Furlan AD (0.25), Ceccherelli F (0.17), Berman BM (0.14), Itoh K (0.11) and Deyo RA (0.11). A comprehensive analysis of co-citation counts and centrality revealed that Simons DG and Furlan AD had an important influence in the field of researching acupuncture on MPS. Simons DG was a clinical professor coming from University of California (USA). One of his biggest achievements was the book of “Myofascial Pain and Dysfunction: The Trigger Point Manual”, in which he explained the clinical characteristics, causes and mechanisms of the myofascial trigger points.^{42,43} Although his hypothesis of energy crisis about the mechanism of MPS was widely accepted by researches, the precise mechanism of MPS is still not clear nowadays. More basic researches are necessary to explore the mechanism of MPS. Furlan AD focused on the treatment of low back pain who was from the institution of work and health in Toronto (Canada). Some of his system reviews and meta-analysis articles

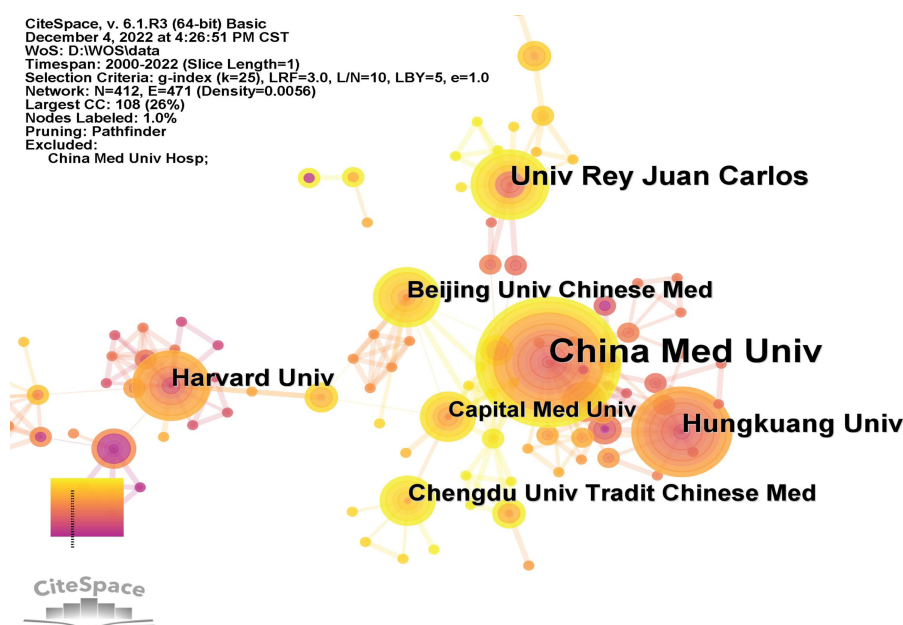


Figure 4 Map of institutions researching acupuncture for MPS from 2000 to 2022. The nodes in the map represent institutions, and the lines between the nodes represent collaborative relationships. The different colors in the nodes represent the different years, and the larger the node area, the larger the number of publications.

Table 5 Top 5 Publications and Centrality of Institutions Related to Acupuncture on MPS

Rank	Publications	Institutions	Centrality	Institutions
1	22	China Med Univ	0.07	Harvard Univ
2	11	Univ Rey Juan Carlos	0.06	China Med Univ
3	10	Hungkuang Univ	0.06	China Acad Chinese Med Sci
4	8	Harvard Univ	0.05	Capital Med Univ
5	7	Chengdu Univ Tradit Chinese Med	0.03	Univ Rey Juan Carlos

indicated that acupuncture and dry-needling might be safe and useful for chronic low back pain, while more high-quality trials with low risk of bias, large sample size are urgently needed to provide sufficient evidences to demonstrate the therapeutic effects of acupuncture therapy on low back pain.^{44–46}

Analysis of Cited Reference

A total of 13,136 references were generated from 403 publications to analysis cited references, and the map with 788 nodes and 2846 links was generated (Figure 7). The top five frequency and centrality of cited references were shown in Table 8 and Table 9 respectively. According to the frequency of cited references, three articles among the top five articles were all the meta-analysis of acupuncture treatment on MPS, indicating that acupuncture, compared to sham or placebo, had overall treatment effects on relieving myofascial trigger point pain, while the evidence was limited. The general problems of most RCTs were the limited sample size and poor quality.^{21,47,48} A double-blinded and randomized controlled trial of acupuncture on MPS conducted by Tekin L, which was ranked third, showed the effectiveness of dry needling compared to sham needling on relieving the pain and improving the quality of life of patients with MPS.⁴⁹ In terms of the centrality, the first was a review published by Simons DG which introduced the clinical features, etiology and treatments of MTrPs and explored how MTrPs may relate to musculoskeletal dysfunction.⁵⁰ The second paper in the ranking list published by Shah JP revealed that the biochemical milieu of the upper trapezius muscle in subjects with active myofascial trigger points differed from subjects without active MTrPs. There were higher concentrations of inflammatory mediators, neuropeptides, cytokines, and catecholamines in the subjects with active MTrPs than in latent or normal subjects.⁵¹ Irnich D and Tekin L conducted a randomized controlled trial, respectively, to identify the effectiveness of acupuncture on MPS, and the results both supported that true acupuncture was superior to sham acupuncture in relieving pain.^{49,52} Over the past 23 years, the researches in this topic mainly focused on meta-analyses, RCTs, analgesic

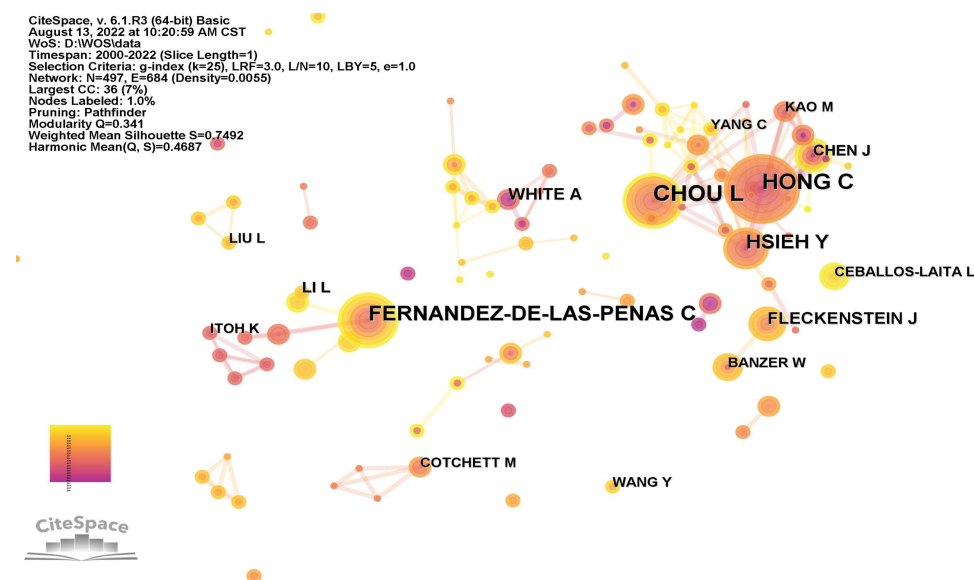


Figure 5 Map of authors related to acupuncture on MPS from 2000 to 2022. The nodes represent authors, and the lines between the nodes represent the collaborative relationships. The different colors of the nodes represent the different years. The larger the node area, the greater the number of publications.

Table 6 Top 10 Active Authors Related to Acupuncture on MPS

Rank	Publications	Author
1	14	Liwei Chou
2	13	Changzern Hong
3	11	Cesar Fernandezdelaspenas
4	9	Yuehling Hsieh
5	6	Adrian R. White
6	6	Fleckenstein J
7	5	Lihui Li
8	5	Jodong Chen
9	4	Chenchia Yang
10	4	Yujen Wang

mechanisms based on biochemical. Generally, the well-designed RCTs with higher quality are urgently needed in the future researches.

Analysis of Keywords

The map of keywords occurrence consisted of 489 nodes and 1996 links (Figure 8) which could indicate hot topics. According to the frequency and centrality, the hot keywords were “acupuncture”, “management”, “low back pain”, “dry needling”, “pain”, “double blind”, “myofascial pain” (Table 10). There were three hot topics: (1) The clinical feature of MPS: muscle pain was the most common and distressing symptom in patients with MPS. It may be accompanied by a sensory of paresthesia and dysesthesia.⁵³ Researches have showed that there were peripheral and central sensitization in MPS.⁵⁴ Therefore, the peripheral and central modulation of acupuncture on MPS was one of the main mechanism research directions. (2) Measure of intervention: acupuncture or dry needling has been widely used for treating MPS.⁵⁵ A randomized controlled trial comparing dry needling to sham dry needling demonstrated that dry needling was effective in relieving the pain and in improving the quality of life of patients with MPS.⁴⁹ Another randomized controlled trial

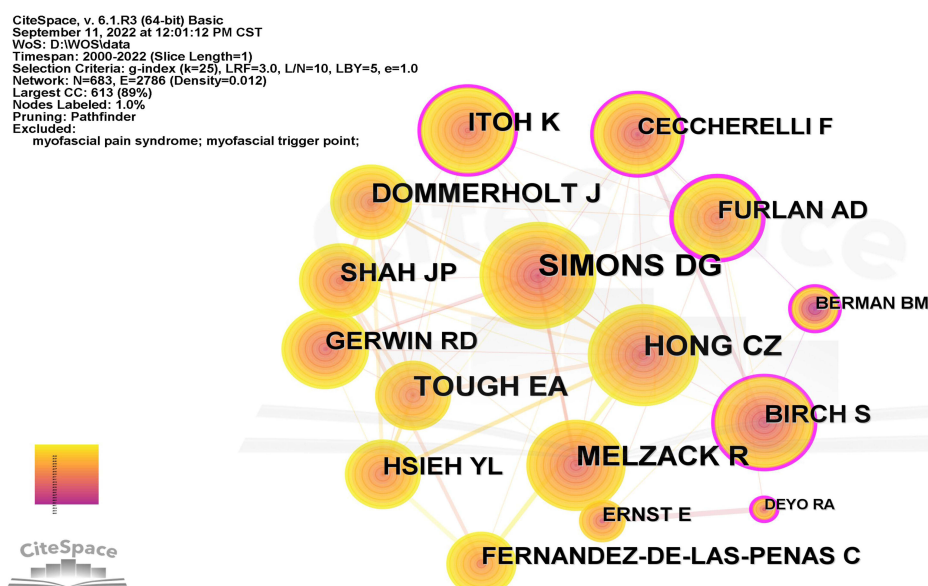


Figure 6 Map of cited author related to acupuncture on MPS from 2000 to 2022. The nodes represent authors, and the lines between the nodes represent the co-citation relationships. The different colors of the nodes represent the different years. The larger the node area, the greater the number of co-citations. The purple ring represents centrality, and nodes with high centrality are considered as pivotal points in the publications.

Table 7 Top 5 Frequency and Centrality of Cited Authors Related to Acupuncture on MPS

Rank	Frequency	Author	Centrality	Author
1	151	Simons DG	0.25	Furlan AD
2	119	Hong CZ	0.17	Ceccherelli F
3	97	Melzack R	0.14	Berman BM
4	94	Tough EA	0.11	Itoh K
5	79	Dommerholt J	0.11	Deyo RA

revealed that trigger point acupuncture may be more effective on patients with chronic neck pain than the standard acupuncture therapy.¹⁷ A meta-analysis of 12 RCT studies comparing dry needling to sham or placebo showed that dry needling decreased pain immediately after treatment and at 4 weeks in patients with upper-quarter MPS.²¹ However, more high-quality RCTs were proposed. Additionally, the acupuncture treatments for patient with MPS were diverse in different studies, and this has emphasized the importance of developing treatments with uniform and optimal parameters such as frequency, duration, and intensity of acupuncture in future researches. (3) Research method: randomized controlled trial was the most effective method to evaluate the clinical efficiency of acupuncture on MPS. Implementation of blinding was an important principle of randomized controlled trial. However, double blinding method to both the acupuncturist and subject was difficult to be conducted in many acupuncture studies, instead single blinding to evaluator and subject was often been performed.^{17,37,52} The implementation of sham acupuncture or placebo was another problem in acupuncture researches. There was no criteria of placebo acupuncture method. Actually, placebo acupuncture may be an effective control with a certain specific effect.⁵⁶ Therefore, the setting of sham acupuncture or placebo should be more strict.

The burst keywords mean keywords that were cited frequently over a period of time. The burst keywords are indicators of the research frontier trends. The top 20 keywords with the strongest citation bursts in the researches of acupuncture on MPS from 2000 to 2022 are shown in Figure 9. The keywords “meta-analysis”, “acupuncture point”, “double blind”, “mechanism”, “irritability” had the strongest citation bursts. As a method of evaluating the effectiveness of acupuncture therapy, meta-analysis was popular in recent four years. Results demonstrated that acupuncture therapy was beneficial in relieving pain, reducing muscle irritability and improving life quality.²¹ In recent years, the mechanism

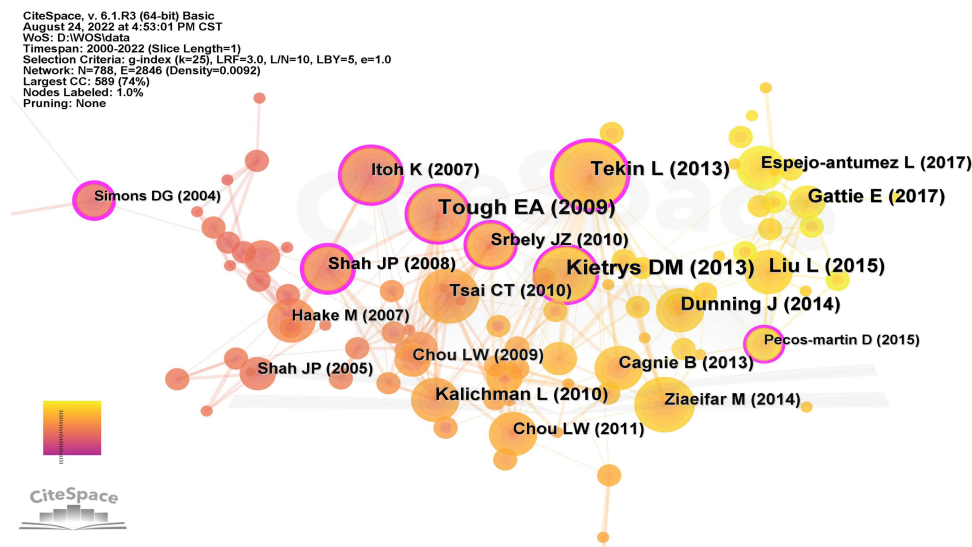


Figure 7 Map of cited references related to acupuncture on MPS from 2000 to 2022. The nodes represent the cited references, and the lines between the nodes represent the co-citation relationships. The different colors of the nodes represent the different years. The larger the node area, the greater the number of co-citations. The purple ring represents centrality, and nodes with high centrality are considered as pivotal points in the publications.

Table 8 Top 5 Frequency of Cited Reference Related to Acupuncture on MPS

Rank	Frequency	Reference	Author and Publication Year
1	28	Acupuncture and dry needling in the management of myofascial trigger point pain: A systematic review and meta-analysis of randomised controlled trials ³⁸	Tough EA (2009)
2	26	Effectiveness of Dry Needling for Upper-Quarter Myofascial Pain: A Systematic Review and Meta-analysis ³⁰	Kietrys DM (2013)
3	21	The effect of dry needling in the treatment of myofascial pain syndrome: a randomized double-blinded placebo-controlled trial ³⁹	Tekin L (2013)
4	20	Effectiveness of Dry Needling for Myofascial Trigger Points Associated with Neck and Shoulder Pain: A Systematic Review and Meta-analysis ⁴³	Liu L (2015)
5	18	Dry needling: a literature review with implications for clinical practice guidelines ⁴⁴	Dunning J (2014)

Table 9 Top 5 Centrality of Cited Reference Related to Acupuncture on MPS

Rank	Centrality	Reference	Author and Publication Year
1	0.20	Review of enigmatic MTrPs as a common cause of enigmatic musculoskeletal pain and dysfunction ⁴⁰	Simons DG (2004)
2	0.15	Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points ⁴¹	Shah JP (2008)
3	0.15	Immediate effects of dry needling and acupuncture at distant points in chronic neck pain: results of a randomized, double-blind, sham-controlled crossover trial ⁴²	Irnich D (2002)
4	0.14	The effect of dry needling in the treatment of myofascial pain syndrome: a randomized double-blinded placebo-controlled trial ³⁹	Tekin L (2013)
5	0.13	Acupuncture and dry needling in the management of myofascial trigger point pain: A systematic review and meta-analysis of randomised controlled trials ³⁸	Tough EA (2009)

researches of acupuncture on MPS mainly focused on acupuncture to the spontaneous electrical activity of the MTrPs, releasing of local pain-causing substances at MTrPs, modulating of peripheral nociception and dorsal horn neuron activity.^{37,55,57} While the basic researches or animal experiments were insufficient compared to clinical researches on acupuncture for MPS, and most of the results were preliminary. More deep basic researches are needed in future researches.

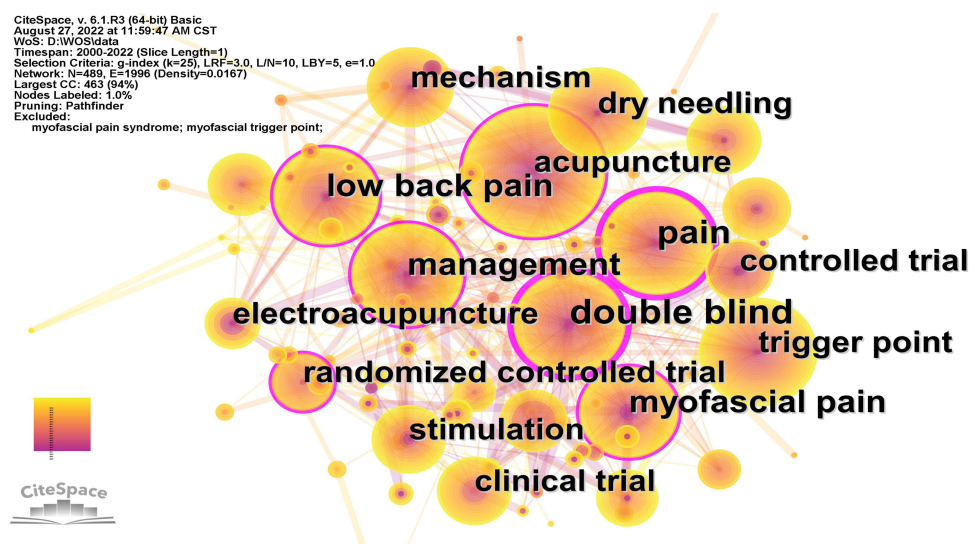


Figure 8 Map of keywords occurrence related to acupuncture on MPS from 2000 to 2022. The nodes represent key words, and the lines between the nodes represent the co-occurrence relationships. The different colors of the nodes represent the different years. The larger the node area, the higher the frequency. The purple ring represents centrality, and nodes with high centrality are considered as pivotal points in the publications.

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

Rank	Frequency	Keywords	Centrality	Keywords
1	158	Acupuncture	0.23	Double blind
2	122	Trigger point	0.21	Pain
3	102	Management	0.16	Management
4	69	Low back pain	0.15	Myofascial pain
5	64	Dry needling	0.12	Low back pain
6	57	Pain	0.11	Acupuncture
7	54	Double blind	0.10	Randomized controlled trial
8	44	Myofascial pain	0.10	Electroacupuncture
9	40	Stimulation	0.09	Dry needling
10	38	Reliability	0.09	Mechanism

Conclusion

The current study shows that MPS received more and more attention in the recent 23 years. According to the analysis of country, institution and author, it was obvious that acupuncture, as a traditional treatment of Chinese medicine, received full attention in China. What is more, acupuncture was also more and more acceptable and popular in the world, especially in developed countries. However, the cooperation between different countries, institutions and authors, especially transnational cooperation, should be further strengthened to promote acupuncture as a complementary therapy method to control pain for MPS.

Top 20 Keywords with the Strongest Citation Bursts

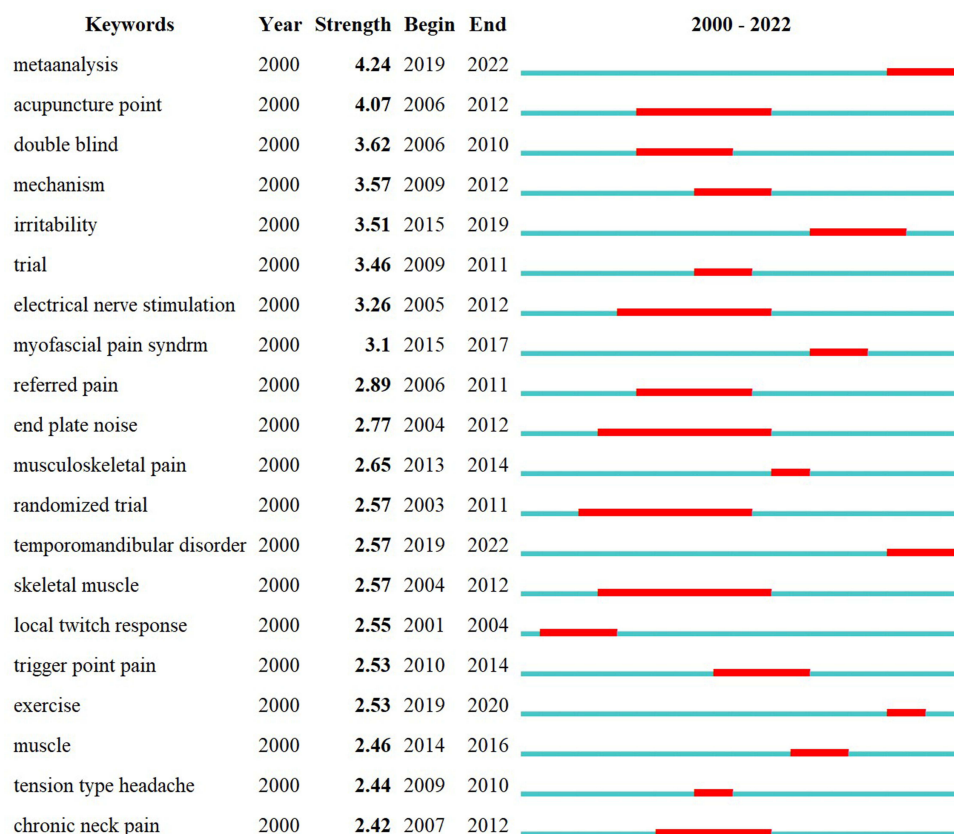


Figure 9 Top 20 keywords with the strongest citation bursts. The red bars mean that the keywords were cited frequently, the green bars showed that the keywords were cited infrequently.

The main research directions were the therapeutic effect and mechanism of acupuncture therapy for MPS. According to the cited reference and keywords, the randomized controlled trial and meta-analysis were the main methods to evaluate the effectiveness of acupuncture treatment on MPS. However, most meta-analysis affirmed the effects of acupuncture on relieving pain, reducing muscle irritability and improving life quality. There was controversy about the therapeutic effects of acupuncture for MPS. Limited sample size and high risk of bias were the common problems. In future researches, more randomized controlled trial studies with multi-center, large scale, double-blinding and high quality are needed. Clinical trials to unify the optimal parameters such as frequency, duration, and intensity of acupuncture should be carried out in the future. The mechanism of acupuncture on MPS mainly focused on pain regulation and electrophysiological mechanism. More deep basic researches are needed in future researches.

In summary, this study provides a perspective to the potential collaborators and institutions, hot topics and research frontiers of acupuncture therapy on MPS. The results may help researchers explore new direction for the future research. However, there are some limitations in the present study. Due to the limitation of CiteSpace software, we only included publications in English from the database of SCI-Expanded, which may result in that the data not be comprehensive enough.

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Disclosure

The authors report no conflicts of interest in this work.

References

- Gregory NS, Sluka KA. Anatomical and physiological factors contributing to chronic muscle pain. *Curr Top Behav Neurosci*. 2014;20:327–348. doi:10.1007/7854_2014_294.
- Galasso A, Urits I, An D, et al. A comprehensive review of the treatment and management of myofascial pain syndrome. *Curr Pain Headache Rep*. 2020;24(8):43. doi:10.1007/s11916-020-00877-5
- Kuan TS. Current studies on myofascial pain syndrome. *Curr Pain Headache Rep*. 2009;13(5):365–369. doi:10.1007/s11916-009-0059-0
- Ibarra JM, Ge HY, Wang C, Martínez Vizcaino V, Graven-Nielsen T, Arendt-Nielsen L. Latent myofascial trigger points are associated with an increased antagonistic muscle activity during agonist muscle contraction. *J Pain*. 2011;12(12):1282–1288. doi:10.1016/j.jpain.2011.09.005
- Badil Güloğlu S, Tunç S. The assessment of affective temperament and life quality in myofascial pain syndrome patients. *Int J Psychiatry Clin Pract*. 2022;26(1):79–84. doi:10.1080/13651501.2020.1833039
- Bennett R. Myofascial pain syndromes and their evaluation. *Best Pract Res Clin Rheumatol*. 2007;21(3):427–445. doi:10.1016/j.berh.2007.02.014
- Vázquez-Delgado E, Cascos-Romero J, Gay-Escoda C. Myofascial pain syndrome associated with trigger points: a literature review. (I): epidemiology, clinical treatment and etiopathogeny. *Med Oral Patol Oral Cir Bucal*. 2009;14(10):e494–e498. doi:10.4317/medoral.14.e494
- Borg-Stein J, Iaccarino MA. Myofascial pain syndrome treatments. *Phys Med Rehabil Clin N Am*. 2014;25(2):357–374. doi:10.1016/j.pmr.2014.01.012
- Peck J, Urits I, Peoples S, et al. A comprehensive review of over the counter treatment for chronic low back pain. *Pain Ther*. 2021;10(1):69–80. doi:10.1007/s40122-020-00209-w
- Guzman J, Haldeman S, Carroll LJ, et al. Clinical practice implications of the bone and joint decade 2000–2010 task force on neck pain and its associated disorders: from concepts and findings to recommendations. *Spine*. 2008;33(4Suppl):S199–S213. doi:10.1097/BRS.0b013e3181644641
- Ramon S, Gleitz M, Hernandez L, Romero LD. Update on the efficacy of extracorporeal shockwave treatment for myofascial pain syndrome and fibromyalgia. *Int J Surg*. 2015;24(Pt B):201–206. doi:10.1016/j.ijsu.2015.08.083
- Xia P, Wang X, Lin Q, Cheng K, Li X. Effectiveness of ultrasound therapy for myofascial pain syndrome: a systematic review and meta-analysis. *J Pain Res*. 2017;10:545–555. doi:10.2147/JPR.S131482
- Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. *Arch Phys Med Rehabil*. 2001;82(7):986–992. doi:10.1053/apmr.2001.24023
- Fredy DM, Harpin D, Mihađja H. The role of acupuncture for myofascial pain syndrome (MPS) in interventional pain management. *J Complement Integr Med*. 2022;19(2):213–217. doi:10.1515/jcim-2021-0525
- Kalichman L, Vulfsons S. Dry needling in the management of musculoskeletal pain. *J Am Board Fam Med*. 2010;23(5):640–646. doi:10.3122/jabfm.2010.05.090296
- Dommerholt J, Hooks T, Chou LW, Finnegan M. Myofascial pain and treatment: editorial. *J Bodyw Mov Ther*. 2019;23(3):521–531. doi:10.1016/j.jbmt.2019.06.009
- Leggit JC. Musculoskeletal therapies: acupuncture, dry needling, cupping. *FP Essent*. 2018;470:27–31.

18. Gerber LH, Shah J, Rosenberger W, et al. Dry needling alters trigger points in the upper trapezius muscle and reduces pain in subjects with chronic myofascial pain. *PMR*. 2015;7(7):711–718. doi:10.1016/j.pmrj.2015.01.020
19. Cerezo-Téllez E, Torres-Lacomba M, Fuentes-Gallardo I, et al. Effectiveness of dry needling for chronic nonspecific neck pain: a randomized, single-blinded, clinical trial. *Pain*. 2016;157(9):1905–1917. doi:10.1097/j.pain.0000000000000591
20. Wang R, Li X, Zhou S, Zhang X, Yang K, Li X. Manual acupuncture for myofascial pain syndrome: a systematic review and meta-analysis. *Acupunct Med*. 2017;35(4):241–250. doi:10.1136/acupmed-2016-011176
21. Kietrys DM, Palombaro KM, Azzaretto E, et al. Effectiveness of dry needling for upper-quarter myofascial pain: a systematic review and meta-analysis. *J Orthop Sports Phys Ther*. 2013;43(9):620–634. doi:10.2519/jospt.2013.4668
22. Hsieh YL, Yang SA, Yang CC, Chou LW. Dry needling at myofascial trigger spots of rabbit skeletal muscles modulates the biochemicals associated with pain, inflammation, and hypoxia. *Evid Based Complement Alternat Med*. 2012;2012:342165. doi:10.1155/2012/342165
23. Felber DT, Malheiros RT, Tentardini VN, Salgueiro ACF, Cidral-Filho FJ, da Silva MD. Dry needling increases antioxidant activity and grip force in a rat model of muscle pain. *Acupunct Med*. 2022;40(3):241–248. doi:10.1177/09645284211056941
24. Chen J, Li W, Huang Y, et al. Needling on trigger point promotes muscle regeneration after bupivacaine injection induced injury. *Neurosci Lett*. 2020;739:135436. doi:10.1016/j.neulet.2020.135436
25. Cagnie B, Dewitte V, Barbe T, Timmermans F, Delrue N, Meeus M. Physiologic effects of dry needling. *Curr Pain Headache Rep*. 2013;17(8):348. doi:10.1007/s11916-013-0348-5
26. Itoh K, Katsumi Y, Hirota S, Kitakoji H. Randomised trial of trigger point acupuncture compared with other acupuncture for treatment of chronic neck pain. *Complement Ther Med*. 2007;15(3):172–179. doi:10.1016/j.ctim.2006.05.003
27. Chen C, SanJuan FI, Hou J. The structure and dynamics of cocitation clusters: a multiple-perspective cocitation analysis. *J Am Soc Info Ence Technol*. 2010;61:7. doi:10.1002/asi.21309.
28. Synnæstvedt MB, Chen C, Holmes JH. CiteSpace II: visualization and knowledge discovery in bibliographic databases. *AMIA Annu Symp Proc*. 2005;2005:724–728.
29. Belter CW. Bibliometric indicators: opportunities and limits. *J Med Libr Assoc*. 2015;103(4):219–221. doi:10.3163/1536-5050.103.4.014
30. Chen C. Searching for intellectual turning points: progressive knowledge domain visualization. *Proc Natl Acad Sci USA*. 2004;101(Suppl1):5303–5310. doi:10.1073/pnas.0307513100
31. Chen C. The centrality of pivotal points in the evolution of scientific networks. 2005 International Conference on Intelligent User Interfaces; 2005:98–105. doi: 10.1145/1040830.1040859
32. Chen C. CiteSpace II: detecting and visualizing emerging trends and transient patterns in scientific literature. *J Am Soc Inf Sci Technol*. 2006;57(3):359–377. doi:10.1002/asi.20317
33. Vickers AJ, Cronin AM, Maschino AC ; Acupuncture Trialists' Collaboration. Acupuncture for chronic pain: individual patient data meta-analysis. *Arch Intern Med*. 2012;172(19):1444–1453. doi:10.1001/archinternmed.2012.3654
34. Airaksinen O, Brox JI, Cedraschi C, et al. Chapter 4. European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J*. 2006;15(Suppl2):S192–S300. doi:10.1007/s00586-006-1072-1
35. Oh S, Kim M, Lee M, Kim T, Lee D, Yoon B. Effect of myofascial trigger point therapy with an inflatable ball in elderly with chronic non-specific low back pain. *J Back Musculoskelet Rehabil*. 2018;31(1):119–126. doi:10.3233/BMR-169696
36. Vickers AJ, Vertosick EA, Lewith G.; Acupuncture Trialists' Collaboration. Acupuncture for chronic pain: update of an individual patient data meta-analysis. *J Pain*. 2018;19(5):455–474. doi:10.1016/j.jpain.2017.11.005
37. Hsieh YL, Kao MJ, Kuan TS, Chen SM, Chen JT, Hong CZ. Dry needling to a key myofascial trigger point may reduce the irritability of satellite MTrPs. *Am J Phys Med Rehabil*. 2007;86(5):397–403. doi:10.1097/PHM.0b013e31804a554d
38. Hsieh YL, Chou LW, Joe YS, Hong CZ. Spinal cord mechanism involving the remote effects of dry needling on the irritability of myofascial trigger spots in rabbit skeletal muscle. *Arch Phys Med Rehabil*. 2011;92(7):1098–1105. doi:10.1016/j.apmr.2010.11.018
39. Tsai CT, Hsieh LF, Kuan TS, Kao MJ, Chou LW, Hong CZ. Remote effects of dry needling on the irritability of the myofascial trigger point in the upper trapezius muscle. *Am J Phys Med Rehabil*. 2010;89(2):133–140. doi:10.1097/PHM.0b013e3181a5b1bc
40. Hsieh YL, Hong CZ, Liu SY, Chou LW, Yang CC. Acupuncture at distant myofascial trigger spots enhances endogenous opioids in rabbits: a possible mechanism for managing myofascial pain. *Acupunct Med*. 2016;34(4):302–309. doi:10.1136/acupmed-2015-011026
41. Chou LW, Hsieh YL, Kao MJ, Hong CZ. Remote influences of acupuncture on the pain intensity and the amplitude changes of endplate noise in the myofascial trigger point of the upper trapezius muscle. *Arch Phys Med Rehabil*. 2009;90(6):905–912. doi:10.1016/j.apmr.2008.12.020
42. Simons DG, Travell JG, Simons LS. *Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual*. 2nd ed. Baltimore: Williams & Wilkins; 1999.
43. Simons DG, Travell JG, Simons L. *Myofascial Pain and Dysfunction. The Trigger Point Manual*. 3th ed. Wolters Kluwer: Philadelphia; 2019.
44. Furlan AD, van Tulder MW, Cherkin DC, et al. Acupuncture and dry-needling for low back pain. *Cochrane Database Syst Rev*. 2005;(1): CD001351. doi:10.1002/14651858.CD001351.pub2
45. Furlan AD, Imamura M, Dryden T, Irvin E. Massage for low back pain: an updated systematic review within the framework of the Cochrane Back Review Group. *Spine*. 2009;34(16):1669–1684. doi:10.1097/BRS.0b013e3181ad7bd6
46. Mu J, Furlan AD, Lam WY, Hsu MY, Ning Z, Lao L. Acupuncture for chronic nonspecific low back pain. *Cochrane Database Syst Rev*. 2020;12(12):CD013814. doi:10.1002/14651858.CD013814
47. Tough EA, White AR, Cummings TM, Richards SH, Campbell JL. Acupuncture and dry needling in the management of myofascial trigger point pain: a systematic review and meta-analysis of randomised controlled trials. *Eur J Pain*. 2009;13(1):3–10. doi:10.1016/j.ejpain.2008.02.006
48. Liu L, Huang QM, Liu QG, et al. Effectiveness of dry needling for myofascial trigger points associated with neck and shoulder pain: a systematic review and meta-analysis. *Arch Phys Med Rehabil*. 2015;96(5):944–955. doi:10.1016/j.apmr.2014.12.015
49. Tekin L, Akarsu S, Durmuş O, Cakar E, Kiralp MZ. The effect of dry needling in the treatment of myofascial pain syndrome: a randomized double-blinded placebo-controlled trial. *Clin Rheumatol*. 2013;32(3):309–315. doi:10.1007/s10067-012-2112-3
50. Simons DG. Review of enigmatic MTrPs as a common cause of enigmatic musculoskeletal pain and dysfunction. *J Electromyogr Kinesiol*. 2004;14(1):95–107. doi:10.1016/j.jelekin.2003.09.018
51. Shah JP, Danoff JV, Desai MJ, et al. Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. *Arch Phys Med Rehabil*. 2008;89(1):16–23. doi:10.1016/j.apmr.2007.10.018

52. Irnich D, Behrens N, Gleditsch JM, et al. Immediate effects of dry needling and acupuncture at distant points in chronic neck pain: results of a randomized, double-blind, sham-controlled crossover trial. *Pain*. 2002;99(1-2):83-89. doi:10.1016/S0304-3959(02)00062-3
53. Saxena A, Chansoria M, Tomar G, Kumar A. Myofascial pain syndrome: an overview. *J Pain Palliat Care Pharmacother*. 2015;29(1):16-21. doi:10.3109/15360288.2014.997853
54. Kilinc O, Sencan S, Ercalik T, et al. Cutaneous silent period in myofascial pain syndrome. *Muscle Nerve*. 2018;57(1):E24-E28. doi:10.1002/mus.25964
55. Fernández-de-Las-Peñas C, Nijs J. Trigger point dry needling for the treatment of myofascial pain syndrome: current perspectives within a pain neuroscience paradigm. *J Pain Res*. 2019;12:1899-1911. doi:10.2147/JPR.S154728
56. Feng S, Li B, Zhang HN, et al. Placebo control and its methodological issues on clinical trials of acupuncture therapy. *Zhongguo Zhen Jiu*. 2022;42(4):437-441. Chinese. doi:10.13703/j.0255-2930.20210204-0002
57. Chen JT, Chung KC, Hou CR, Kuan TS, Chen SM, Hong CZ. Inhibitory effect of dry needling on the spontaneous electrical activity recorded from myofascial trigger spots of rabbit skeletal muscle. *Am J Phys Med Rehabil*. 2001;80(10):729-735. doi:10.1097/00002060-200110000-00004

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