

A Bibliometric Analysis of Acupuncture Treatment of Tension-Type Headache from 2003 to 2022

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Background: Acupuncture therapy is a unique technology created by the working people in ancient China. It is popular all over the world for its safety, effectiveness and no side effects, especially for the treatment of pain syndrome, it can often have an immediate effect. Tension-type headache is one of them. At present, many literatures have reported that many countries in the world are using acupuncture to treat tension-type headache, but there is no quantitative analysis of the relevant literature on this field. Therefore, This study aims to evaluate the research hotspots and trends of acupuncture treatment of tension-type headache through a macro review of the literature from 2003 to 2022 by using CiteSpace V6.1.R6 (64-bit) Basic.

Methods: Relevant literatures on acupuncture treatment of tension-type headache from 2003 to 2022 were extracted from the web of science core collection database. CiteSpace was used to analyze the data of publications, authors, institutions, countries, keywords and cited references, cited authors, cited journals. Draw the cited network map and analyze the research hotspots and trends.

Results: A total of 231 publications were retrieved from 2003 to 2022. In the past 20 years, the annual number of publications has shown an overall growth trend, and the most active journals, countries, institutions, authors, cite references and keywords in the field of acupuncture treatment of tension-type headache were identified.

Conclusion: This study provides the status and trends of clinical research in the field of acupuncture therapy for tension-type headache in the past 20 years, which will help researchers understand the research hotspots in this field and provide new directions for further research.

Keywords: acupuncture therapy, tension-type headache, bibliometric analysis, CiteSpace, research trends

Introduction

Tension-type headache (TTH) is a kind of painful disease characterized by mild and moderate compression or constriction-like pain that usually occurs in both sides of the head, and the symptoms do not worsen with daily activities.¹ It is the most common type of headache in clinical practice.² TTH often presents non-pulsatory swelling pain, dull pain, accompanied by a sense of tightness or oppression, and the pain site is not fixed, which can be manifested as bilateral temporal, unilateral temporal, full head, neck, two occipital pain, and often accompanied by symptoms such as dizziness, anxiety, depression, insomnia, etc. According to the epidemiological survey, the lifetime prevalence rate of tension-type headache in the normal general population is as high as 30%–78%,³ even as high as 87%,⁴ and the prevalence rate in the global adults is as high as 42%.⁵ The disease usually starts around the age of 20, and reaches its peak between the ages of 35–40. The incidence rate of women is slightly higher than that of men, and the average course of disease is also longer than that of men.⁶ It often attacks repeatedly, which seriously affects the work efficiency and social life of patients, and increases the social and economic burden.⁷ A recent study on the global disease burden system analysis published in The Lancet showed that among the eight major chronic diseases affecting more than 10% of the world's population, tension-

type headache ranked second.⁸ Because of its high incidence rate, high social and economic burden and other characteristics, it has become one of the hot research diseases in the medical community.⁹

At present, there are three kinds of drugs for the treatment of this disease in clinic:¹⁰ first, acute analgesics, mainly non-steroidal anti-inflammatory drugs; Second, preventive drugs, mainly antidepressants; Third, symptom relief drugs, mainly muscle relaxants. Although the use of these drugs has a certain effect on the treatment of this disease, the duration of the effect is relatively short, and the side effects of long-term use are obvious,^{11,12} and it is easy to have a relapse or even aggravation after stopping the drug. Therefore, in recent years, researchers have begun to shift more attention to non-drug therapy,¹³ and acupuncture as a safe and effective physical therapy is favored by more and more patients with TTH. In 2009 and 2016, German scholars successively carried out a meta-analysis of the high-quality clinical research results of acupuncture treatment for TTH, and found that acupuncture is an effective non-drug treatment for the treatment of frequent onset TTH and chronic TTH, which can significantly reduce the number of headache episodes and pain degree of patients compared with conventional treatment or sham acupuncture treatment.^{1,14}

Bibliometrics is an interdisciplinary subject that uses mathematical and statistical methods to study the distribution structure, quantitative relationship, change law and quantitative management of document information, and then discusses some structures, characteristics and laws of science and technology.¹⁵ It is a comprehensive knowledge system that integrates mathematics, statistics and philology and focuses on quantification. In particular, the application of information visualization technology means and methods can intuitively display the research development process, research status, research hotspot and development trend of the subject.^{16–21}

CiteSpace is a commonly used bibliometric analysis software, which is developed by Professor Chen Chaomei of Drexel University and has a visual analysis function. It is often used to analyze, identify and display the research progress and current research frontiers of a certain discipline, as well as the corresponding knowledge base, especially scientific citation analysis.^{22–24} In this way, researchers can intuitively understand the research trends, hotspots and classical sources of the discipline, and provide reference for subsequent research.^{21,25,26}

In recent years, a large number of clinical studies have shown that acupuncture has been widely used to treat TTH;^{27–32} However as far as we know, there is no bibliometric analysis of acupuncture treatment of TTH based on CiteSpace. The purpose of this study is to evaluate the research hotspots and trends of acupuncture treatment of TTH by using CiteSpace to conduct a macro review of the literature from 2003 to 2022.

Methods

Source of Literature

To avoid omissions in the search literature, we obtained the synonyms for “Tension-Type Headache” and “acupuncture Therapy” through the MeSH Database in PubMed, we find the Entry Terms of “Tension-Type Headache” include “Headache, Tension-Type”, “Headaches, Tension-Type”, “Tension Type Headache”, “Tension-Type Headaches”, “Idiopathic Headache”, “Headache, Idiopathic”, “Headaches, Idiopathic”, “Idiopathic Headaches”, “Stress Headache”, “Headache, Stress”, “Headaches, Stress”, “Stress Headaches”, “Tension Headache”, “Headache, Tension”, “Headaches, Tension”, “Tension Headaches”, “Psychogenic Headache”, “Headache, Psychogenic”, “Headaches, Psychogenic”, “Psychogenic Headaches”, “Tension-Vascular Headache”, “Headache, Tension-Vascular”, “Headaches, Tension-Vascular”, “Tension Vascular Headache”, “Tension-Vascular Headaches”. The Entry Terms of “acupuncture Therapy” include “Acupuncture Treatment”, “Acupuncture Treatments”, “Treatment, Acupuncture”, “Pharmacoacupuncture Therapy”, “Acupotomy”, “Pharmacoacupuncture Treatment”, “Treatment, Pharmacoacupuncture”, “Therapy, Pharmacoacupuncture”, “Acupotomies”, “Therapy, Acupuncture” and some other synonyms that we found from other articles.^{25,33} We put it together to searching, All data collection was performed on January 5, 2023, searching the WOSCC for all literature published ranged from January 1, 2003, to December 31, 2022. The search was not limited to the language, category or document type. Two authors independently searched the references. Any differences were resolved by Wei Xu and Qiangjian Mao, and a total of 231 references were identified, as shown in Table 1. The searched scientific network database is from the library database of Jiangxi University of Traditional Chinese Medicine, China.

Table 1 Search Queries

Set	Results	Search Query
#1	8388	TS= (Tension-Type Headache OR Headache, Tension-Type OR Headaches, Tension-Type OR Tension Type Headache OR Tension-Type Headaches OR Idiopathic Headache OR Headache, Idiopathic OR Headaches, Idiopathic OR Idiopathic Headaches OR Stress Headache OR Headache, Stress OR Headaches, Stress OR Stress Headaches OR Tension Headache OR Headache, Tension OR Headaches, Tension OR Tension Headaches OR Psychogenic Headache OR Headache, Psychogenic OR Headaches, Psychogenic OR Psychogenic Headaches OR Tension-Vascular Headache OR Headache, Tension-Vascular OR Headaches, Tension-Vascular OR Tension Vascular Headache OR Tension-Vascular Headaches)
#2	22,542	TS=(Acupuncture Therapy OR Acupuncture Treatment OR Acupuncture Treatments OR Treatment, Acupuncture OR Therapy, Acupuncture OR Pharmacopuncture Treatment OR Treatment, Pharmacopuncture OR Pharmacopuncture Therapy OR Therapy, Pharmacopuncture 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	231	#1 AND #2

Note: # 1 represents step1.

Analysis Tool

The visualization adopts the CiteSpace software invented by Professor Chen Chaomei from the Department of Computer and Information Science of Drexel University, the version is 6.1.R6 (64-bit) Basic, which is used to analyze the structure, law and distribution of scientific knowledge.^{18,23}

The CiteSpace parameters are as follows: time slices, 2003–2022; years per slice (1); source terms, all options; node selection type, one at a time; pruning, pathfinder. The visual knowledge graph is mainly composed of nodes and links. Different nodes represent different elements, such as authors, institutions, countries, and keywords. Each node has different colors from the inside to the outside to represent different years (2003–2022). The connecting lines between each node indicate simultaneous references. The purple circle represents centrality, and the darker the purple color, the higher the centrality and the more important it is.^{34,35}

Results and Discussion

Analysis of Publication Outputs

A very important evaluation indicator of scientific research development is the number of annual publications, which reflects the growth of knowledge in this field to a certain extent. The number of papers published annually in the field of acupuncture treatment of TTH, as shown in [Figure 1](#). $y = 0.2338x + 9.0947$ $R^2 = 0.1322$, It shows that the reliability of the trend line is very high. From the figure, we can see that there are two peak periods, with 18 articles published in 2009 and 19 articles published in 2021. This shows that during these two periods, the research on acupuncture treatment of TTH is very popular. The number of articles published in 2007 was the lowest, with only 5 articles. Although the number of papers published in the past 20 years has been high and low, the overall trend is still growing steadily, which shows that the research in this field is getting more and more widespread attention, which also reflects the acupuncture therapy as an auxiliary treatment method has received more and more attention.

Analysis of Journals and Cited Journals

A total of 231 references were included in this study, mainly consisting of six document types. There were 130 journal articles, accounting for 56.3% of the total references, which was the most common type of literature. Followed by 79 review articles, accounting for 34.2% and 13 editorial materials, 6 meeting abstracts, 2 correction, 1 letters, as shown in [Figure 2](#).

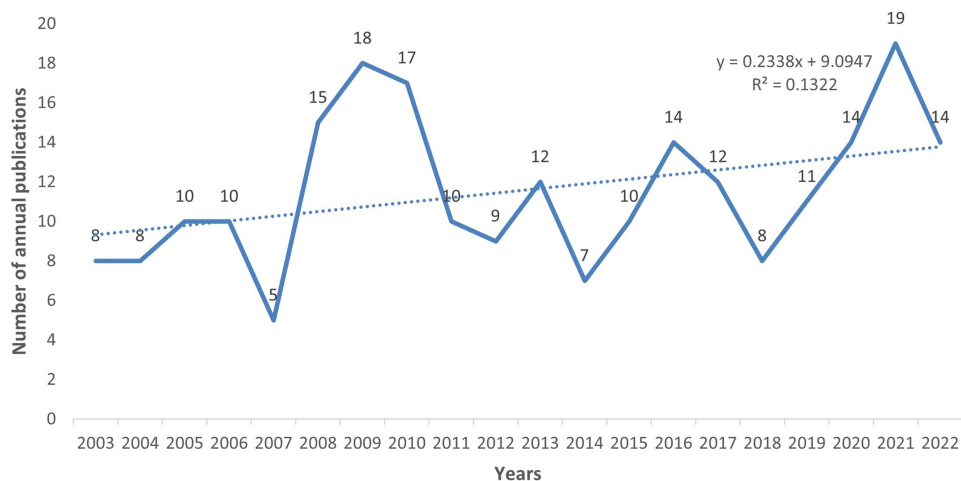


Figure 1 The annual number of publications on acupuncture for TTH from 2003 to 2022.

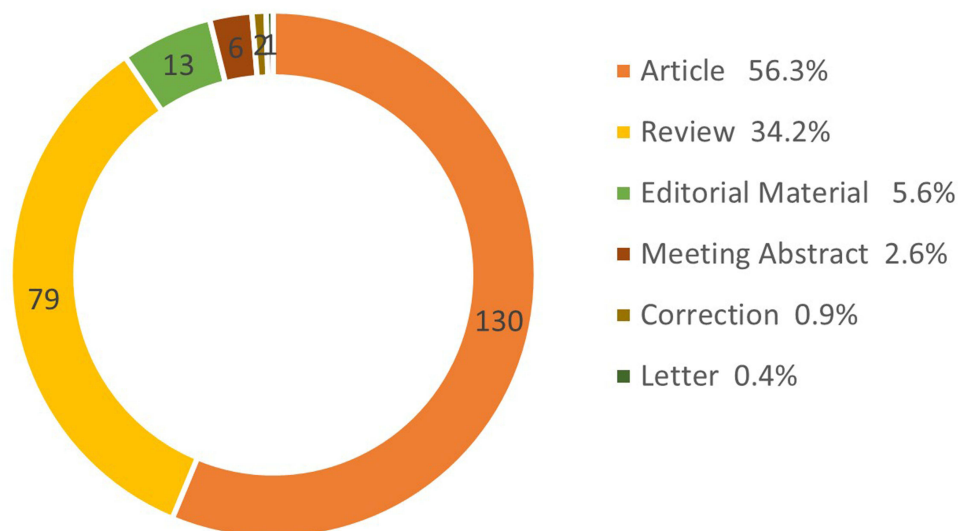


Figure 2 The type of publications on acupuncture for TTH from 2003 to 2022.

In the field of acupuncture treatment of TTH, the journal with the largest number of articles is CEPHALALGIA, with 14 articles; followed by the Journal of HEADACHE, with a total of 11 articles; the Journal of EVIDENCE BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE ranked third, with a total of 9 articles. And the most impact factor (IF) in the top 10 publications is the journal of JOURNAL OF HEADACHE AND PAIN, with an IF of 8.588, and a total of 6 articles. The average IF of the top 10 publications is 3.7788, as all shown in Table 2.

Combining joint citations with centrality, CiteSpace produced a map of journals cited, including the total number of 2974 references, as shown in Figure 3 and Table 3. The nodes in the figure represent different journals, and the connecting lines between the nodes represent the co-citation relationship. The more lines, the closer the connection. Different colors in the nodes represent different years. The larger the area of the node, the higher the number of co-references. Purple rings represent centrality, and nodes with high centrality are considered as the key points in the literature. Through the table, there is no difficult for us to find the first in the frequency is the journal of CEPHALALGIA and the first in the centrality is the journal of AM J CHINESE MED. This shows that the journal is highly representative and persuasive in this research field, and the citation rate is also very high, which can provide strong evidence for our research. Among the top 3 journals and cited journals, there are two common points: the journal of CEPHALALGIA and

Table 2 Top 10 Journals Related to Acupuncture for TTH

Rank	Publications	Journal	IF (2022)	Rank	Publications	Journal	IF (2022)
1	14	Cephalalgia	6.075	6	7	Medicine	1.817
2	11	Headache	5.311	7	6	Current Pain and Headache Reports	3.904
3	9	Evidence-Based Complementary and Alternative Medicine	2.650	8	6	Journal of Headache and Pain	8.588
4	8	Journal of Alternative and Complementary Medicine	2.381	9	6	Trials	2.728
5	7	Acupuncture in Medicine	1.976	10	5	EXPLORE: The Journal of Science and Healing	2.358

the journal of HEADACHE. This reflects that the research topics of the two journals are very similar, and they are closely related.

Through CiteSpace software, we generated a double graph overlay of the journals and cited journals (Figure 4). The left side represents the journal, and the right side represents the cited journal. There are four path links in the figure. The green path indicates that research published in “medicine, medical and clinic” journals tends to cite journals mainly in the fields of “health, nursing, medicine” and “psychology, education and social”. The orange path indicates that the research published in the journals of “neurology, sports, ophthalmology” is more inclined to cite journals in the fields of “health, nursing, medicine” and “psychology, education and social”. This also shows that there are many links between these disciplines, and provides a direction for further research in the future. From these four path links, it is not difficult to find that the research in this field is relatively concentrated, focusing on medical, health, neurology, education and other aspects, which also provides convenience for our future research.

Distribution of Countries and Institutions

A country distribution map with 32 nodes and 80 links consisting of merged networks was generated (Figure 5). Different nodes in the map represent different countries or regions. Lines between multiple nodes indicate mutual cooperation. Researchers from 32 countries published 231 articles, the top 10 publishing countries are shown in Table 4.

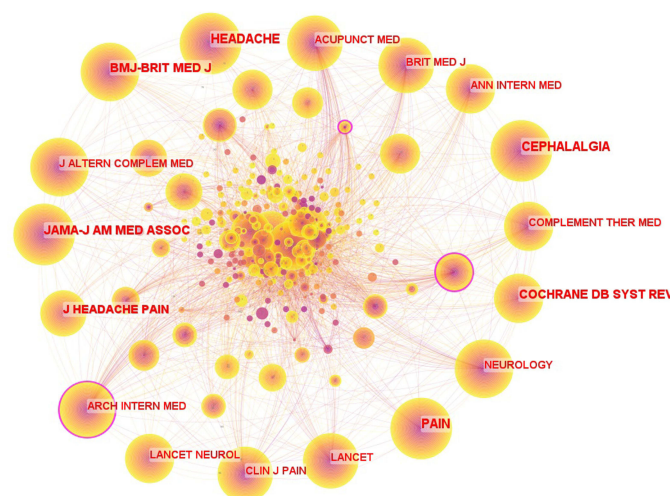
**Figure 3** Cited journal map related to acupuncture for TTH from 2003 to 2022.

Table 3 Top10 Cited Journals and Centrality Related to Acupuncture for TTH

Rank	Cited Journal	Frequency	Rank	Cited Journal	Centrality
1	Cephalalgia	182	1	The American Journal of Chinese Medicine	0.14
2	Pain	160	2	Archives of Internal Medicine	0.12
3	Headache	154	3	The American Journal of Medicine	0.11
4	Jama-Journal of The American Medical Association	130	4	BMJ-British Medical Journal	0.1
5	Cochrane Database of Systematic Reviews	118	5	Acupuncture & Electro-Therapeutics Research	0.09
6	BMJ-British Medical Journal	116	6	Acupuncture in Medicine	0.08
7	The Journal of Headache and Pain	102	7	Neurology	0.08
8	Lancet	89	8	Spine	0.08
9	The Journal of Alternative and Complementary Medicine	88	9	Neurological Sciences	0.08
10	The Clinical Journal of Pain	84	10	Archives of Physical Medicine and Rehabilitation	0.08

The USA ranks first with 69 articles published, and GERMANY ranked second with 43 articles published. From Table 4, we can know that the top 10 countries for centrality, The top three are the USA (0.22), Germany (0.18), Italy (0.13), which shows that the USA and GERMANY have done a lot of research in this field, and they are closely connected, and indicating that acupuncture therapy has been widely used in the the western countries to treat TTH. China have the largest number of publications in Asia.

The institutional contribution distribution graph consists of 353 nodes and 635 links (Figure 6). Different nodes in the map represent different institutions. The connection between the two nodes indicates the mutual cooperation relationship between the institutions. From the Figure, we can see that a total of 353 institutions are devoted to the research of acupuncture treatment of TTH, but the relationship between them is not so close, because the institutional network map is a low-density map (density=0.0102). The top 10 institutions with the most published articles and the highest centrality are shown in the Table 5. It is not difficult to find that Memorial Sloan Kettering Cancer Center, Technical University of Munich and University of York have conducted research in this field in different periods of time, while other institutions

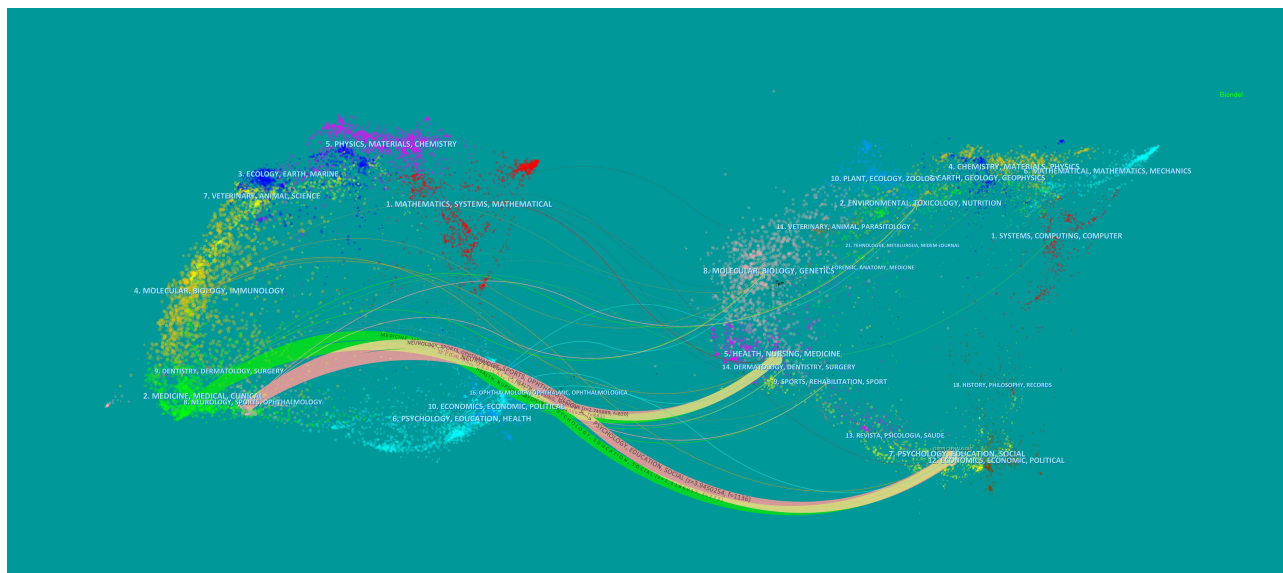


Figure 4 Dual-map overlay of journals related to Acupuncture for TTH. The left side of the dual map is citing journals while the right side is cited journals, and the line in the middle indicates the association between them.

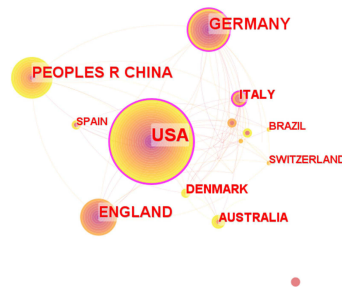


Figure 5 Map of countries researching acupuncture for TTH from 2003 to 2022.

have only conducted this research in a certain period of time. So compared with other institutions, Memorial Sloan Kettering Cancer Center has studied this field for a longer time and more in-depth.

Analysis of Authors and Cited Authors

Our analysis of authors of 231 publications yielded 481 nodes and 864 links (Figure 7). Different nodes in the map represent different authors, and the connections between multiple nodes represent the mutual cooperation between authors. From the data we concluded that 231 articles were published by 481 authors with 864 links to each other, the author map is designed to show the most prolific authors or co-authors and reflects the close collaboration between authors, which can help us discovering influential research groups can also help researchers find information about potential collaborators, and help researchers establish cooperative relationships, providing the possibility for higher-quality research, which will help to better study the causes of acupuncture treatment on TTH in the future. Professor Linde, Klaus has published the most articles which with 12, Next is Professor Macpherson, Hugh with 8, any other publications see Table 6 for details. Although these authors have published many articles on the

Table 4 Top10 Publications and Centrality of Countries Related to Acupuncture for TTH

Rank	Publications	Countries	Rank	Centrality	Countries
1	69	The United States of America	1	0.22	The United States of America
2	43	Germany	2	0.18	Germany
3	34	The People's Republic Of China	3	0.13	Italy
4	28	England	4	0.09	Australia
5	15	Australia	5	0.09	Denmark
6	14	Italy	6	0.09	Canada
7	14	Denmark	7	0.02	The People's Republic Of China
8	12	Switzerland	8	0.01	Spain
9	10	Spain	9	0.01	Greece
10	10	Brazil	10	0.01	Austria

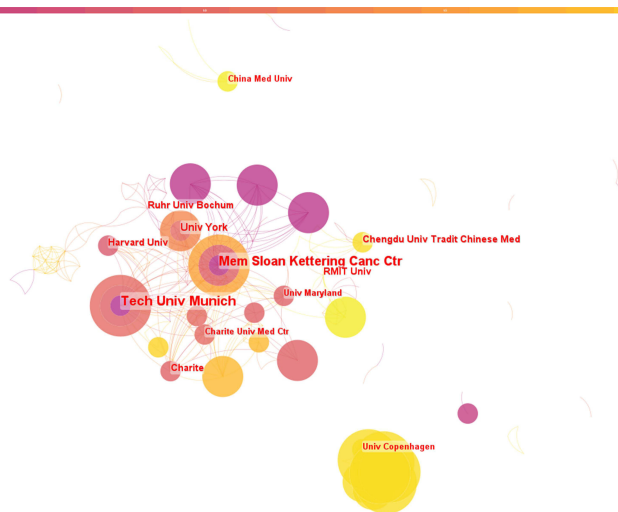


Figure 6 Map of institutions researching acupuncture for TTH from 2003 to 2022.

treatment of TTH with acupuncture, it is not difficult to see that there is a lack of close connection between these authors (density=0.0075), and the authors in different periods are different, which indicates that their research may lack continuity. This may have a certain impact on acupuncture treatment of TTH in different regions and different periods.

The graph of cited authors consists of 567 nodes and 2748 links (Figure 8). The most cited is LINDE K (119), following by MELCHART D (102), SILBERSTEIN SD (65), KARST M (54) and VICKERS AJ (53) (Table 7). Top 10 centrality of cited authors included BERMAN BM (0.19), ALLAIS G (0.15), MACPHERSON H (0.14), DIENER HC (0.13), LIPTON RB (0.1), BENDTSEN L (0.09), KAPTCHUK TJ (0.09), KARST M (0.08), BRINKHAUS B (0.07), ERNST E (0.07) (Table 8). Professor Linde, Klaus from the University of Munich, Germany, has the highest number of papers and citation rate, which shows that he has done a lot of research in the field of acupuncture treatment of TTH and is very authoritative.^{14,32,36-39} This provides us with potential partners for future research in this field.

Table 5 Top10 Publications and Centrality of Institutions Related to Acupuncture for TTH

Rank	Publications	Institutions	Rank	Centrality	Institutions
1	18	Tech Univ Munich	1	0.08	Heidelberg Univ
2	14	Mem Sloan Kettering Canc Ctr	2	0.07	Tech Univ Munich
3	8	Univ York	3	0.07	Mem Sloan Kettering Canc Ctr
4	7	Charite	4	0.07	Ruhr Univ Bochum
5	6	Chengdu Univ Tradit Chinese Med	5	0.05	Univ N Carolina
6	6	Harvard Univ	6	0.04	Beijing Univ Chinese Med
7	6	RMIT Univ	7	0.04	NYU
8	6	Ruhr Univ Bochum	8	0.03	Harvard Univ
9	5	Charite Univ Med Ctr	9	0.03	Univ Maryland
10	5	China Med Univ	10	0.03	China Acad Chinese Med Sci

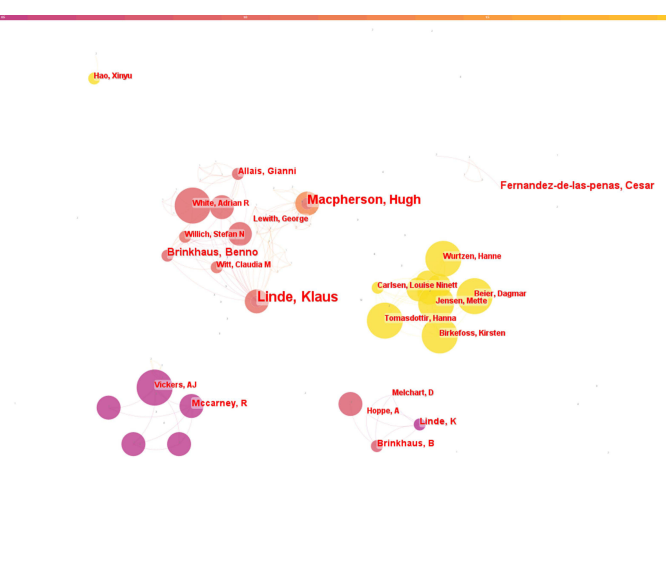


Figure 7 Map of authors related to acupuncture for TTH from 2003 to 2022.

Analysis of Cited References

The map of citing references consists of 663 nodes and 2212 links as shown in Figure 9. The top 10 cited reference frequencies are shown in Table 7; the top 10 cited reference centrality are shown in Table 9. By analyzing these literatures with high co-citation frequency and centrality, the research hotspots and knowledge base of the topic can be obtained. The first cited references is a randomized controlled trial,⁴⁰ in which the author points out that both acupuncture and sham acupuncture are effective for migraine, but there is no evidence that acupuncture is more effective. The second is also a randomized controlled trial,⁴¹ in this paper the author also believes that acupuncture is effective for TTH.

The first centrality of cited references is a review.⁴² By analyzing 22 published papers (4985 participants), the author concluded that acupuncture is effective for treating headache and can be used as a routine treatment method, but more research and long-term observation of curative effect are needed.

Analysis of Keywords

An indicator for evaluating cutting-edge topics or new trends is an increase in the number of keywords burst citations or an increase in keyword frequency over a certain period of time. Generated a keyword co-occurrence graph consisting of 371 nodes and 1815 links, as shown in Figure 10. By analyzing the frequency and centrality of keywords, we found the most used keywords are “tension type headache”, “acupuncture”, “migraine”, “low back pain”, “randomized controlled trial”, “double blind”, “efficacy”, “pain”, “tension-type headache” and “clinical trial” as shown in Table 10. Figure 11 shows the top 15 keywords with the strongest citation burst from 2003 to 2022. “Burst words” are keywords that are frequently used in a given period of time,

Table 6 Top10 Prolific Authors Related to Acupuncture for TTH

Rank	Publications	Author	Rank	Publications	Author
1	12	Linde, Klaus	6	4	Allais, Gianni
2	8	Macpherson, Hugh	7	4	Brinkhaus, B
3	6	Brinkhaus, Benno	8	4	Mccarney, R
4	5	Fernandez-de-las-penas, Cesar	9	3	Vickers, AJ
5	4	Linde, K	10	3	Hoppe, A

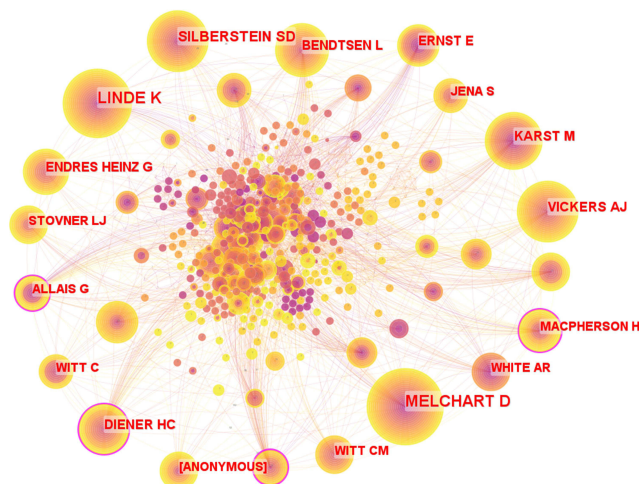


Figure 8 Map of cited authors related to acupuncture for TTH from 2003 to 2022.

which can reflect a current research hotspot. As shown, keywords associated with citation bursts first appeared in 2003. This shows that the research on acupuncture for TTH started from 2003.

The most centrality keywords are “acupuncture”, “low back pain”, “double blind”, “pain” and “clinical trial”. We can know that the current research focus is a randomized controlled clinical study of acupuncture in the treatment of TTH. At present, there are still many disputes about the efficacy of acupuncture, and different researchers hold different views. Some people^{28,29,43–45} found that there was no significant difference in the intensity and frequency of headache relief between acupuncture and sham acupuncture. He believes that more relevant research should be carried out to test its effectiveness. Others believe that acupuncture is effective in treating TTH.^{1,46,47}

General Information

As far as we know, this is the first bibliometric study on acupuncture treatment of TTH. The general information obtained from the results is as follows:

Table 7 Top10 Frequency of Cited References Related to Acupuncture for TTH

Rank	Frequency	References	Author and Publication Year
1	33	JAMA-J AM MED ASSOC, V293, P2118, DOI 10.1001/jama.293.17.2118	Linde K, 2005
2	33	BMJ-BRIT MED J, V331, P376, DOI 10.1136/bmj.38512.405440.8F	Melchart D, 2005
3	21	J HEADACHE PAIN, V8, P306, DOI 10.1007/s10194-007-0416-5	Endres Heinz G, 2007
4	18	COCHRANE DB SYST REV, V0, P0, DOI 10.1002/14651858.CD007587.pub2	Linde K, 2016
5	17	COCHRANE DB SYST REV, V0, P0, DOI 10.1002/14651858.CD001218.pub2	Linde K, 2009
6	16	LANCET NEUROL, V5, P310, DOI 10.1016/S1474-4422(06)70382-9	Diener HC, 2006
7	16	LANCET, V366, P136, DOI 10.1016/S0140-6736(05)66871-7	Witt C, 2005
8	15	CEPHALALGIA, V21, P637, DOI 10.1046/j.1468-2982.2001.00198.x	Karst M, 2001
9	14	CEPHALALGIA, V28, P969, DOI 10.1111/j.1468-2982.2008.01640.x	Jena S, 2008
10	14	COCHRANE DB SYST REV, V0, P0, DOI 10.1002/14651858.CD007587	Linde K, 2009

Table 8 Frequency and Centrality of the Top 10 Cited Authors Related to Acupuncture for TTH

Rank	Frequency	Author	Rank	Centrality	Author
1	119	LINDE K	1	0.19	BERMAN BM
2	102	MELCHART D	2	0.15	ALLAIS G
3	65	SILBERSTEIN SD	3	0.14	MACPHERSON H
4	54	KARST M	4	0.13	DIENER HC
5	53	VICKERS AJ	5	0.1	LIPTON RB
6	52	DIENER HC	6	0.09	BENDTSEN L
7	48	ENDRES HEINZ G	7	0.09	KAPTCHUK TJ
8	45	BENDTSEN L	8	0.08	KARST M
9	38	ERNST E	9	0.07	BRINKHAUS B
10	36	WHITE AR	10	0.07	ERNST E

1. In the past 20 years, the number of publications per year has risen and fallen, but the overall trend is increasing, which indicates that this research field is a promising direction. The incidence rate of TTH is getting higher and higher, and it is expected that the number of publications in the field of acupuncture treatment will also increase.
2. The journal of CEPHALALGIA with the highest citation frequency and centrality. This shows that the journal has more and authoritative research in the field of acupuncture treatment of TTH, which provides reference and focus for future researchers.
3. The USA is the country with the largest number of publications and the highest centrality. This may be related to the high incidence rate of TTH in the USA, and compared with drug treatment, people in the USA are more likely to receive acupuncture, rehabilitation and other non drug treatments. Americans have a high acceptance of acupuncture. They think it is a green and healthy treatment.
4. In terms of publishing institutions, the largest number is from the University of Munich in Germany, while the most central is Heidelberg University. This shows that Germany has also done a lot of research in this field, and

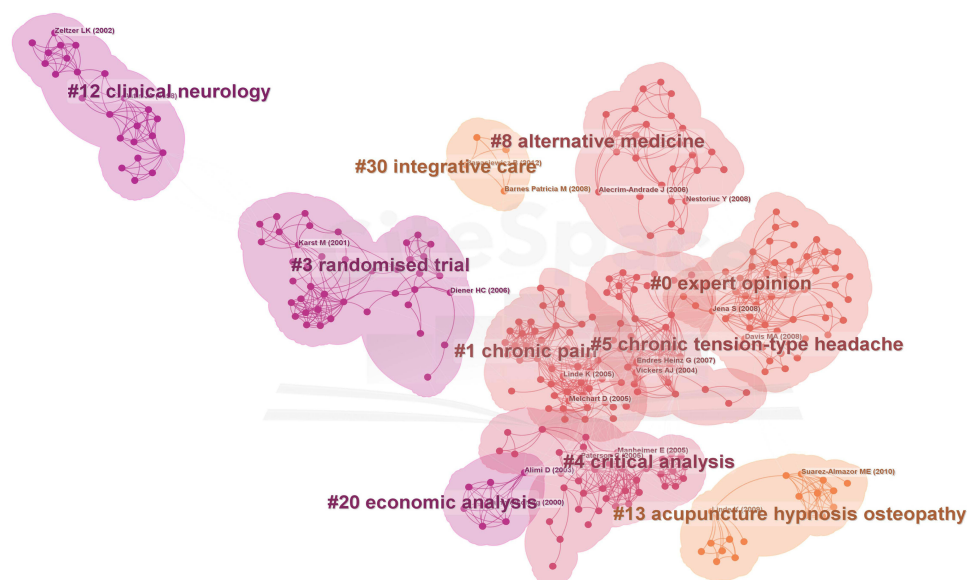
**Figure 9** Map of cited references related to acupuncture for TTH from 2003 to 2022.

Table 9 Top10 Centrality of Cited References Related to Acupuncture for TTH

Rank	Centrality	References	Author and Publication Year
1	0.13	COCHRANE DB SYST REV, V0, P0, DOI 10.1002/14651858.CD001218.pub3	Linde K, 2016
2	0.07	CEPHALALGIA, V21, P637, DOI 10.1046/j.1468-2982.2001.00198.x	Karst M, 2001
3	0.07	HEADACHE, V53, P459, DOI 10.1111/j.1526-4610.2012.02271.x	Adams J, 2013
4	0.06	HEADACHE, V42, P855, DOI 10.1046/j.1526-4610.2002.02203.x	Allais G, 2002
5	0.06	CONTINUUM (MINNEAP MINN), V18, P796, DOI 10.1212/01.CON.0000418643.24408.40	Mauskop Alexander, 2012
6	0.05	CEPHALALGIA, V28, P969, DOI 10.1111/j.1468-2982.2008.01640.x	Jena S, 2008
7	0.05	COCHRANE DB SYST REV, V0, P0, DOI 10.1002/14651858.CD011681	Banzi R, 2015
8	0.05	FORSCH KOMP KLAS NAT, V10, P179, DOI 10.1159/000073473	Melchart D, 2003
9	0.05	GENOME ANNOUNCEMENTS, V4, P0, DOI 10.1128/genomeA.00102-16	Horn F, 2016
10	0.05	CLIN J PAIN, V17, P296, DOI 10.1097/00002508-200112000-00003	Carlsson CPO, 2001

Germany is the second most published country in this field, second only to the USA. However, the links between different institutions are not close enough, and they lack effective cooperation.

5. Professor Linde, Klaus is the most active author and is cited the most frequently. He has done a lot of research on acupuncture treatment of chronic pain,^{36,39} especially TTH,^{1,14,37,38} He believes that acupuncture has a positive effect on TTH, but more experiments are needed to prove this claim. This also provides potential partners and directions for our future research.
6. The most cited references in terms of frequency and centrality are the articles published by Linde K. In these articles, the author believes that acupuncture is effective for TTH, but more clinical trials and long-term curative effect observation are needed.
7. In terms of key words, “tension type headache”, “acupuncture” and “migraine” have always been the research hotspots, “tension type headache”, “disability” and “quality of life” are burst words. This shows that the ability and quality of life of patients with TTH are getting more and more attention.
8. Through the bibliometric research of CiteSpace, we can know the current research situation of acupuncture and moxibustion treatment of tension headache, including the state, institutions, authors, keywords, cited literature,

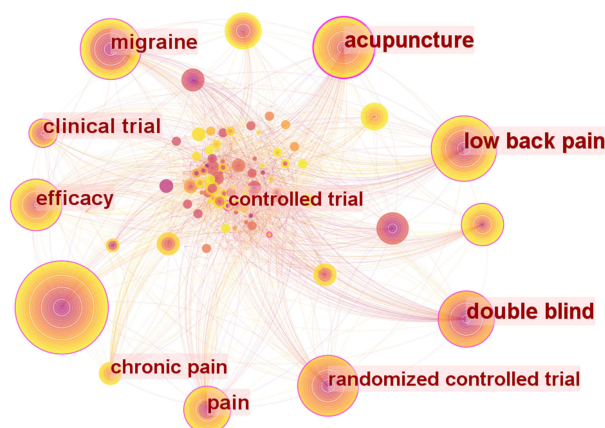


Figure 10 Map of keywords occurrence related to acupuncture for TTH from 2003 to 2022.

Table 10 Top 10 Frequency and Centrality of Keywords Related to Acupuncture for TTH

Rank	Keyword	Frequency	Rank	Keyword	Centrality
1	Tension type headache	109	1	Acupuncture	0.21
2	Acupuncture	53	2	Low back pain	0.18
3	Migraine	49	3	Double blind	0.18
4	Low back pain	49	4	Pain	0.16
5	Randomized controlled trial	44	5	Clinical trial	0.13
6	Double blind	40	6	Controlled trial	0.13
7	Efficacy	34	7	Cluster headache	0.13
8	Pain	27	8	Randomized controlled trial	0.12
9	Tension-type headache	25	9	Efficacy	0.12
10	Clinical trial	23	10	Tension type headache	0.11

cited journals, etc., and we can understand the hot spots and trends in this field. But we also found some problems: at present, acupuncture and moxibustion treatment of tension headache mainly focuses on clinical trials, focusing on clinical efficacy. The research on its mechanism is relatively small, and the basic animal research is insufficient. This also greatly limits its development.

Top 15 Keywords with the Strongest Citation Bursts

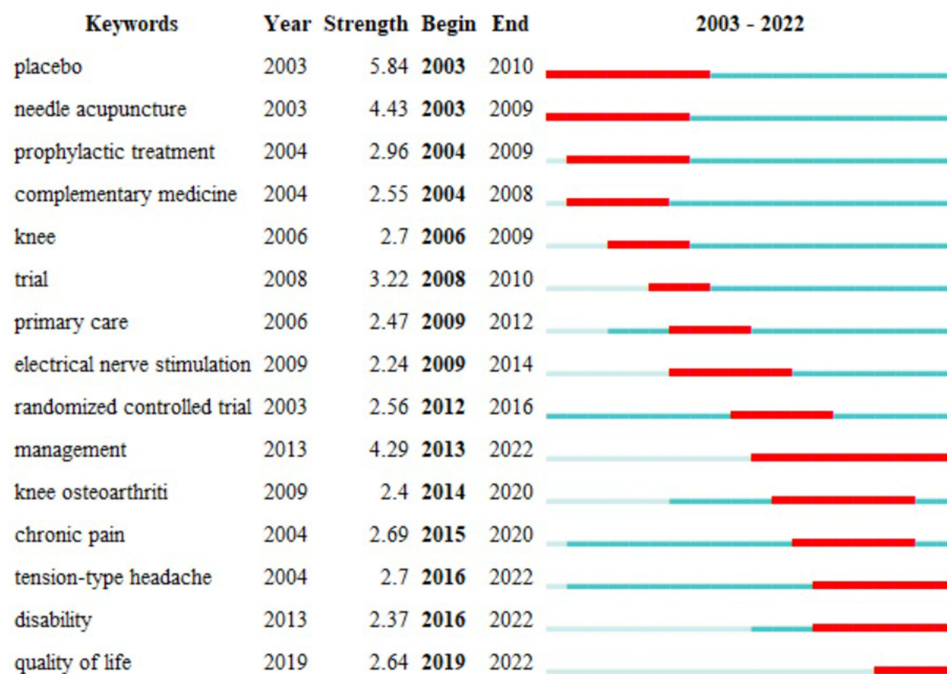


Figure 11 Top 15 keywords with the strongest citation bursts. The red bars demonstrated that the keyword was cited frequently, the green bars showed that the keyword was cited infrequently.

Conclusion

To sum up, this study provides potential collaborators, institutions and research hotspots, thus providing a perspective for the development trend of acupuncture treatment of TTH, which may help researchers explore new research directions in this field in the future.

Acupuncture treatment of TTH should have a positive effect in alleviating the degree and frequency of headache, but due to the lack of rigorous experimental programs and design ideas, many people hold a negative attitude towards its efficacy. So our next research direction is how to design a scientific and reasonable experimental program, and how to use acupuncture therapy to better improve the quality of life of patients with TTH.

Data Sharing Statement

Raw data were obtained directly from the Web of Science Core Collections (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 accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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