

Research Hotspots of Acupuncture Treatment for Myopia Over the Past Decade: A Bibliometric Analysis (2014–2023)

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Objective: To explore the research hotspots in acupuncture treatment for myopia from 2014 to 2023.

Methods: A comprehensive search was conducted in the Science Citation Index-Expanded (SCI-E) within the Web of Science Core Collection (WOSCC). We used CiteSpace 6.2.R6 to perform an in-depth analysis of the annual publication trends, prolific authors, institutions, keyword co-occurrences, and citation bursts. The study followed the PICO framework: the population (P) includes studies on patients with myopia, the intervention (I) is acupuncture treatment, no direct comparison (C) is applied, and the primary outcome (O) focuses on the identification of research trends and hotspots. Major outcome assessments included the analysis of publication trends over time, author productivity, influential journals, and the detection of emerging research topics through citation burst analysis. This bibliometric analysis was conducted on November 15, 2023.

Results: A total of 281 articles were included in the analysis. The trend line of annual publications over the past decade showed a modest increase, with a significant decline in 2019 and a surge in 2021. China and its affiliated academic institutions led globally in publication volume, with Ma Xiaopeng being the most prolific author and Fudan University the most influential institution. *Ophthalmology* emerged as the journal with the highest citation frequency. The most frequently occurring keywords were related to adolescent myopia and its complications. The developmental trajectory of the field is distinct, characterized by the integration of a single discipline.

Conclusion: Acupuncture shows promise as a complementary and alternative therapy for treating myopia, with growing interest in its clinical efficacy and mechanisms of action. Future research is likely to focus on optimizing treatment protocols and understanding the underlying biological mechanisms of acupuncture in myopia management.

Keywords: myopia, acupuncture, bibliometric analysis

Introduction

Myopia is a prevalent visual impairment, has escalated into a grave public health concern worldwide.^{1,2} Studies reveal that the prevalence of myopia ranges between 80%-90%,³ with an alarming rate of 75.35% among children and adolescents aged 5–20 years in China.⁴ The best clinical management practices, such as exercises, rest, and eye health exercises, aim to ensure sufficient rest for the eyes.^{5–8} However, adherence is often low due to demanding academic and work commitments.^{9,10} Additionally, some patients, for cosmetic reasons, opt for laser corneal surgery,¹¹ which is appropriate only for adults with stable myopia and carries risks of complications like dry eye syndrome and corneal infections.^{12–15} Thus, a majority of patients seek safe and effective alternative treatments.

Acupuncture is a hallmark therapy of traditional Chinese medicine, has been employed in China for thousands of years.^{16,17} Its clinical efficacy in treating myopia is supported by high-quality research evidence.¹⁸ Several studies indicate that acupuncture can enhance ocular and periocular blood circulation and affect the peripheral nervous system by stimulating specific acupoints, thereby improving ocular blood flow and neural functions.^{19–21} However,

a comprehensive bibliometric study on the academic collaboration networks, developmental trends, and research frontiers in the field of acupuncture treatment for myopia is still lacking.

CiteSpace is a sophisticated bibliometric tool that enables the visualization and analysis of the structure and dynamics of scientific knowledge.²² By facilitating both qualitative and quantitative analyses, it effectively maps collaborative networks, highlighting co-authorship, institutional affiliations, and keyword co-occurrences. One of the key advantages of CiteSpace is its ability to detect emerging trends and significant research fronts, achieved through the identification of burst terms and pivotal turning points in scientific literature. This functionality allows researchers to uncover hidden patterns and shifts in research focus that might be overlooked in traditional narrative literature reviews, which often lack the quantitative rigor needed for comprehensive insight. Furthermore, CiteSpace employs advanced algorithms that yield data-driven analyses, making it possible to systematically assess the evolution of research topics over time.^{23,24}

The necessity of bibliometric analysis is underscored by its capacity to provide a holistic view of a research field, elucidating not only influential authors, institutions, and countries but also mapping the collaborative dynamics that shape scientific inquiry. In this study, we leverage CiteSpace to analyze literature on acupuncture treatment for myopia sourced from the Web of Science Core Collection (WoSCC) over the past decade. This multifaceted approach enables us to identify not only the prominent contributors in the field but also the research hotspots, while offering predictive insights into future developments. By integrating bibliometric analysis, this study enhances our understanding of the evolving landscape of acupuncture research, highlighting its growing recognition as a complementary therapy for myopia.

Materials and Methods

Data Sources, Eligibility Criteria, and Search Strategy

In this study, all data were sourced from the SCI-E within WoSCC, a database widely regarded as a leading resource in the field. Our data retrieval strategy was based on the PICO (Population, Intervention, Comparison, Outcome) framework to ensure a systematic and structured approach. The key topics were “myopia” (Population: individuals with myopia) and “acupuncture” (Intervention: acupuncture treatments for myopia). No specific comparison (C) or control interventions were included in this bibliometric analysis, as the focus was on mapping the research landscape. The primary outcomes (O) were the trends, hotspots, and influential publications in this area (Figure 1).

The search spanned a decade of publications, from November 15, 2014, to November 15, 2023, and was completed within a single day, on November 15, 2023. No geographical restrictions were imposed on the publishing countries, but we limited the language to English and the document type to “article”.^{25,26} A total of 281 articles were identified. These were exported from the database, formatted, and renamed as “download_****.txt”. After importing them into CiteSpace 6.2.R6 for duplicate removal, no repetitions were found.

Analysis Tool

The maps generated by CiteSpace 6.2.R6 typically include Nodes, Links, Colors, Clusters, and a Timeline. Here, nodes often represent different research articles, authors, journals, or keywords, with the size of a node usually denoting its significance or influence, such as citation frequency. Links illustrate the relationships between nodes, like citations or collaborations, with the thickness of a link possibly indicating the strength or frequency of the relationship. Different colors may signify various time periods or distinct research fields or categories. Clusters, formed by closely connected nodes, represent specific research themes or areas, aiding in understanding the major branches and trends within a field. The Timeline depicts the evolution of keywords or themes over time. Interpreting these maps helps us identify hot topics, developmental trends, and collaborative networks in the realm of acupuncture treatment for myopia.

The parameters used in CiteSpace 6.2.R6 are as follows: Time slices covered the past decade (2014–2023), with each slice representing one year. All terms were included, such as “title”, “abstract”, “author keywords”, and “KeyWords Plus”. To enhance the clarity of the final generated maps, we set the k value of the g-index to 50 and employed the Pathfinder algorithm.^{23,24,27} This approach was taken to ensure that the visual representations of our data were both comprehensive and discernible, allowing for a more effective analysis of the complex networks within our study. The Pathfinder algorithm, in particular, helps in simplifying and clarifying the network by retaining the most significant

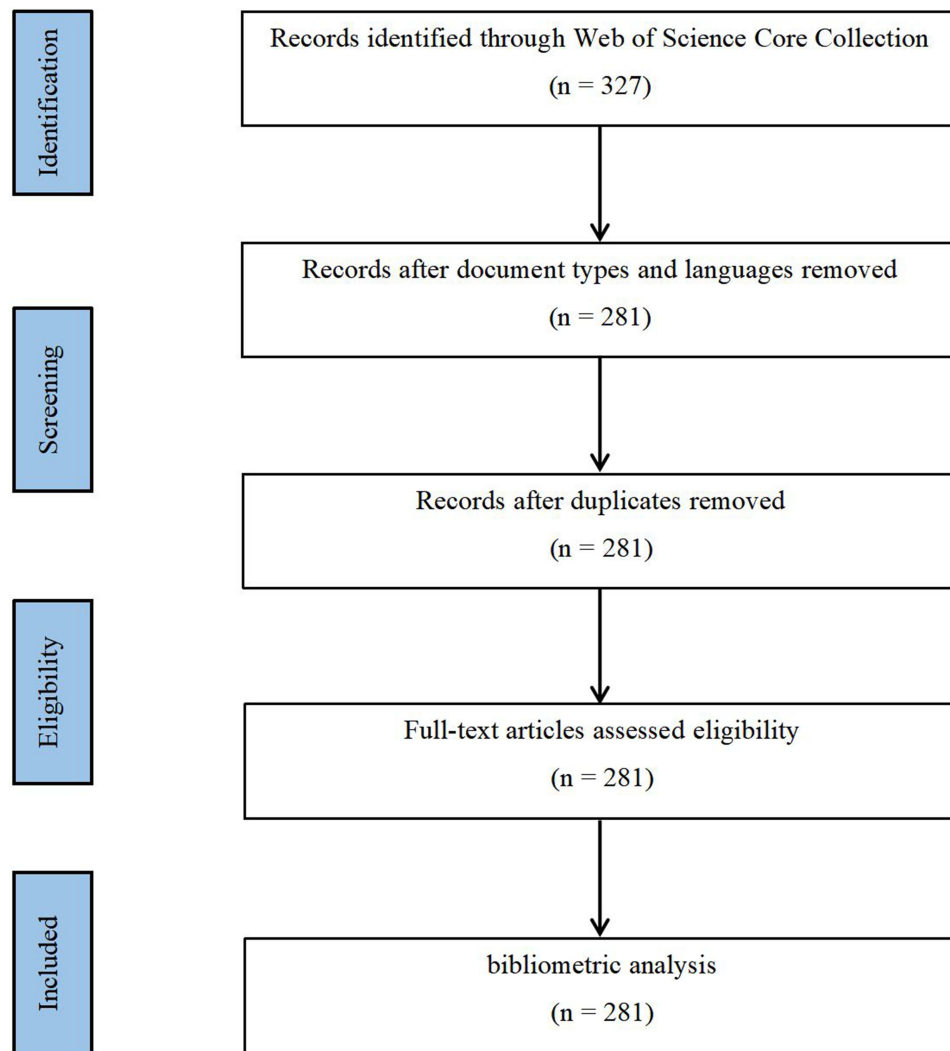


Figure 1 Map of literature screening process related to acupuncture for myopia.

connections, thereby facilitating a clearer understanding of the intricate relationships within the dataset. In addition to these settings, betweenness centrality was calculated to measure the importance of nodes within the network, highlighting influential articles and key connections between different research clusters. These metrics, in conjunction with the Pathfinder algorithm, provide a comprehensive overview of the research landscape, facilitating a deeper understanding of both individual contributions and broader thematic trends.

Results

Analysis of Annual Publications

Observing the publication trend over the past decade in the field of acupuncture treatment for myopia, a modest upward trajectory is apparent (Figure 2 and [Supplementary material Table 1](#)). However, this period also witnessed two significant shifts: a sharp decline in 2019 and a sudden surge in 2021. Our investigation into relevant international policies revealed that the World Health Organization's (WHO) global report in 2019 underscored the need for robust evidence to support the use of acupuncture for common ailments like myopia, to prevent potential harm to patients. In 2021, acupuncture was featured for the first time in the prestigious academic journal "Nature", providing a modern neuroanatomical basis for acupuncture therapy.²⁸ This landmark scientific discovery likely enhanced the visibility of acupuncture research and increased the volume of publications. Additionally, in 2021, the Chinese government released the "14th Five-Year

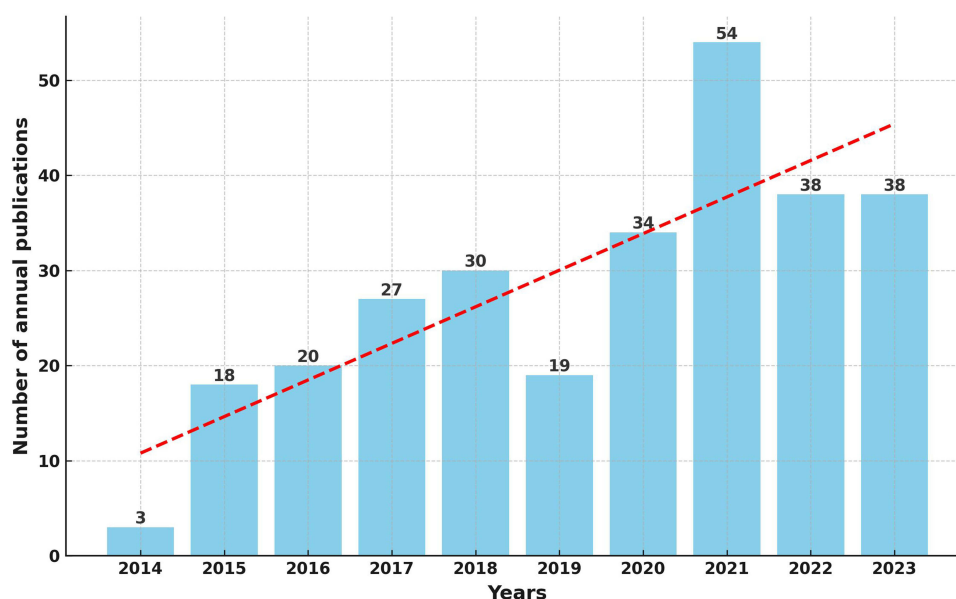


Figure 2 Map of annual publications related to acupuncture for myopia.

National Eye Health Plan (2021–2025)”, signifying the government’s emphasis on eye health, including the use of traditional methods like acupuncture for treating myopia.

Analysis of Authors

Figure 3 and [Supplementary material Table 2](#) illustrate the author collaboration network, comprising 474 nodes and 738 connections. The top ten authors, in order, are Ma Xiaopeng, Wan Lei, Chang Ching-Yao, Tien Peng-Tai, Lin Hui-Ju, Jonas Jost B, Zhou Xingtao, Chen Zhi, Zhao Yue, and Han Rong. Notably, 90% of these authors are from China, reflecting the widespread acceptance of acupuncture for treating myopia within the country. This also correlates with China’s status as the birthplace of acupuncture culture.

Analysis of Countries

Figure 4 and [Supplementary material Table 3](#) display the national collaboration network, consisting of 44 nodes and 56 edges. The top ten countries in terms of publication quantity are, in order: People’s Republic of China, USA, India, Japan, England, Germany, Italy, Turkey, Spain, and Canada. Additionally, our results indicate that the USA (0.34), England (0.26), and Germany (0.17) exhibit higher centrality (indicated by purple rings). Surprisingly, despite having the highest number of publications, China shows a lower centrality, suggesting that Chinese scholars have a lesser presence in leading international academic journals. This may be attributed to the substantial clinical workload of Chinese doctors, limiting their capacity to engage deeply in research, which could be a primary factor for their lower centrality.

Analysis of Institutions

Figure 5 and [Supplementary material Table 4](#) present the institutional collaboration network, which is composed of 272 nodes and 440 edges. The institutions with the highest number of publications, in descending order, are: Fudan University; Shanghai University of Traditional Chinese Medicine; Jefferson University; Chinese Academy of Medical Sciences - Peking Union Medical College; University of London; Shanghai Jiao Tong University; Duke University; Ruprecht Karls University Heidelberg; Asia University Taiwan; and China Medical University Taiwan. The results reveal that 60% of the top 10 institutions are based in China. The network of institutional collaborations indicates that multiple countries have established cooperative relationships, underscoring the global interest in the clinical specificity of acupuncture treatment for myopia.

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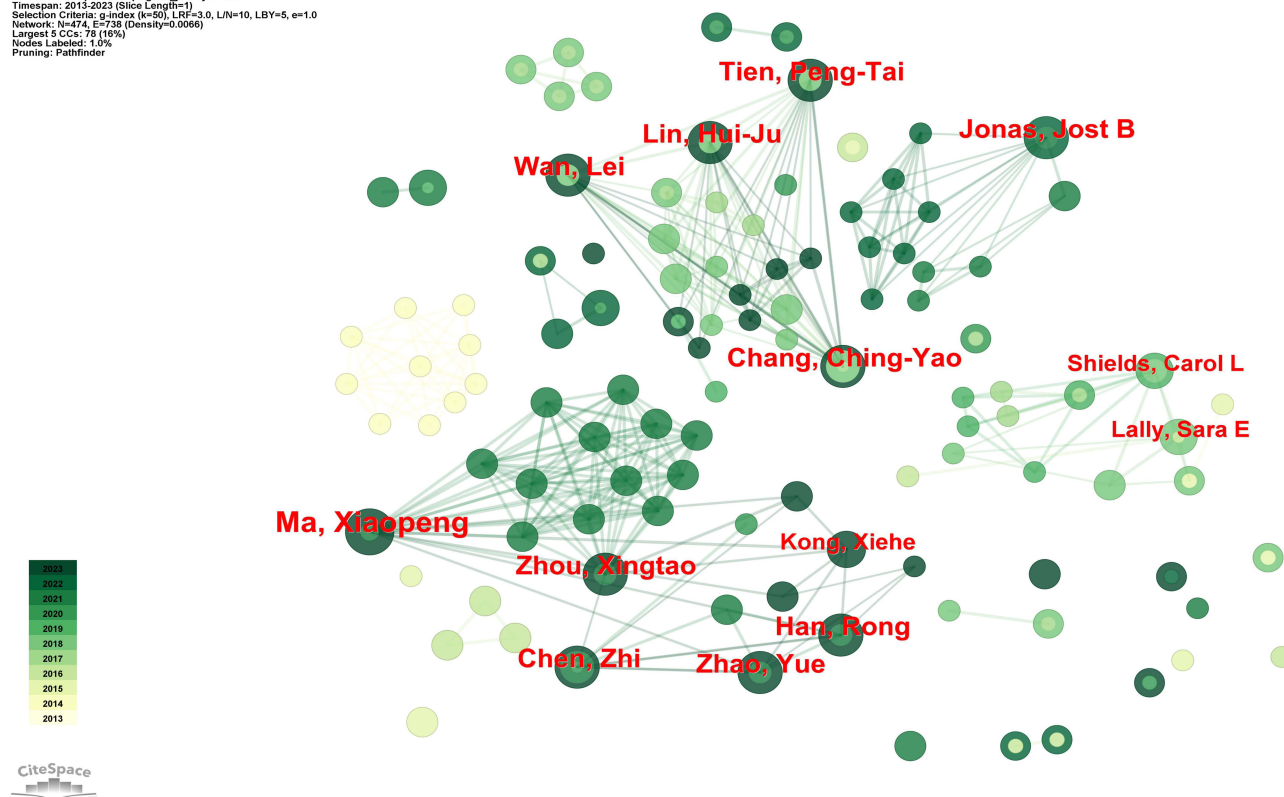


Figure 3 Map of authors related to acupuncture for myopia.

Analysis of Cited Journals

Figure 6 and [Supplementary material Table 5](#) display the network of cited journals, consisting of 646 nodes and 3628 edges. The top ten journals by citation frequency are: *Ophthalmology*; *American Journal of Ophthalmology*; *British Journal of Ophthalmology*; *Archives of Ophthalmology-Chicago*; *Eye*; *Journal of Cataract & Refractive Surgery*; *Graefe's Archive for Clinical and Experimental Ophthalmology*; *Investigative Ophthalmology & Visual Science*; *Retina-The Journal of Retinal and Vitreous Diseases*; and *Acta Ophthalmologica*. Furthermore, our results show that *Clinical and Experimental Optometry* (0.14) and *Brain Research* (0.10) exhibit higher centrality (indicated by purple rings). These journals are among the most influential in the field of acupuncture treatment in ophthalmology and include comprehensive international top-tier journals like *Nature* and *Lancet*.

Analysis of Keywords and Citation Burst

Figure 7 and [Supplementary material Table 6](#) showcase the keyword network, consisting of 461 nodes and 1301 edges. The top ten keywords are, in order: “implantation”, “outcome”, “complications”, “scleral fixation”, “management”, “surgery”, “eyes”, “efficacy”, “mitomycin c”, and “intraocular pressure”. Additionally, the keywords “children” (0.23), “complications” (0.20), and “endophthalmitis” (0.20) exhibit notable centrality. Analyzing the frequency and centrality of these keywords reveals a heightened focus on myopia in children and complications associated with myopia.

Figure 8 illustrates the top 20 keywords with the most significant citation bursts in the field of acupuncture treatment for myopia from 2014 to 2023. The light blue area delineates the research period, while the red sections indicate the onset and climax of the bursts. The increase in influence correlates with the rise in “strength” values. We observed that “eyes” had the highest burst strength, reaching 2.19. Additionally, in the early stages, “eye” and “management” garnered considerable attention, indicating a clinical emphasis on the prevention of myopia at that time. In the later stages,

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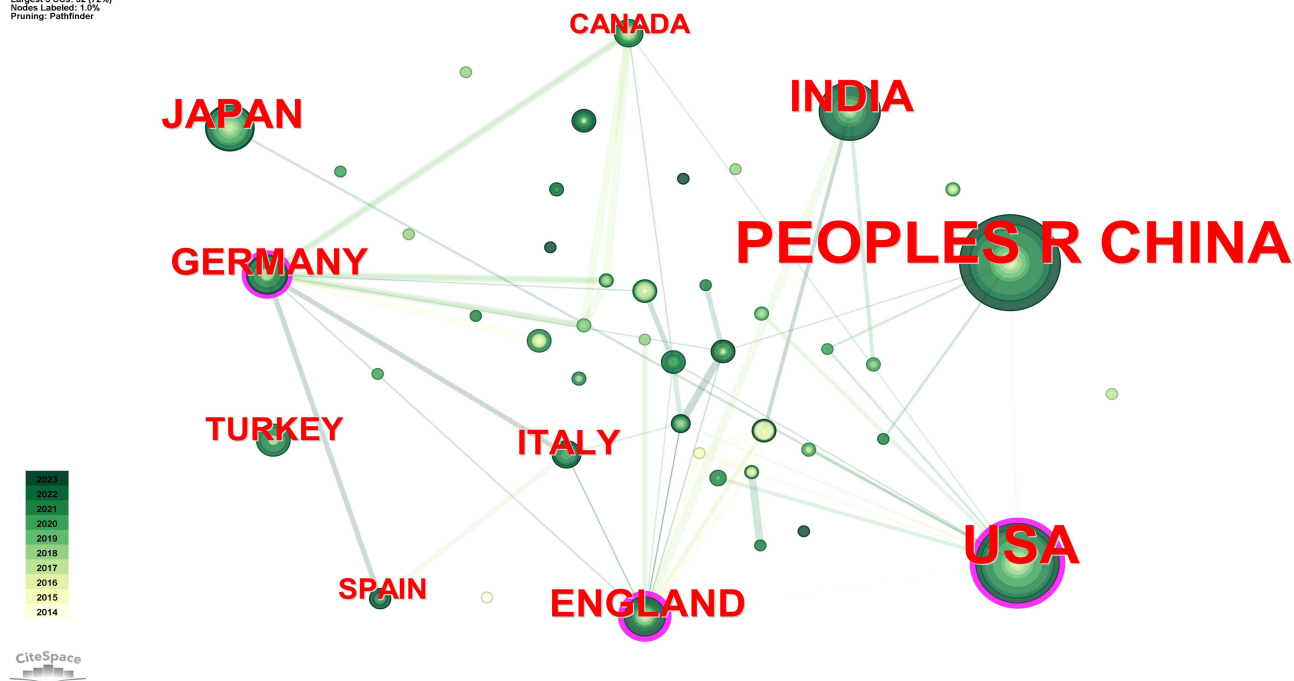


Figure 4 Map of countries related to acupuncture for myopia.

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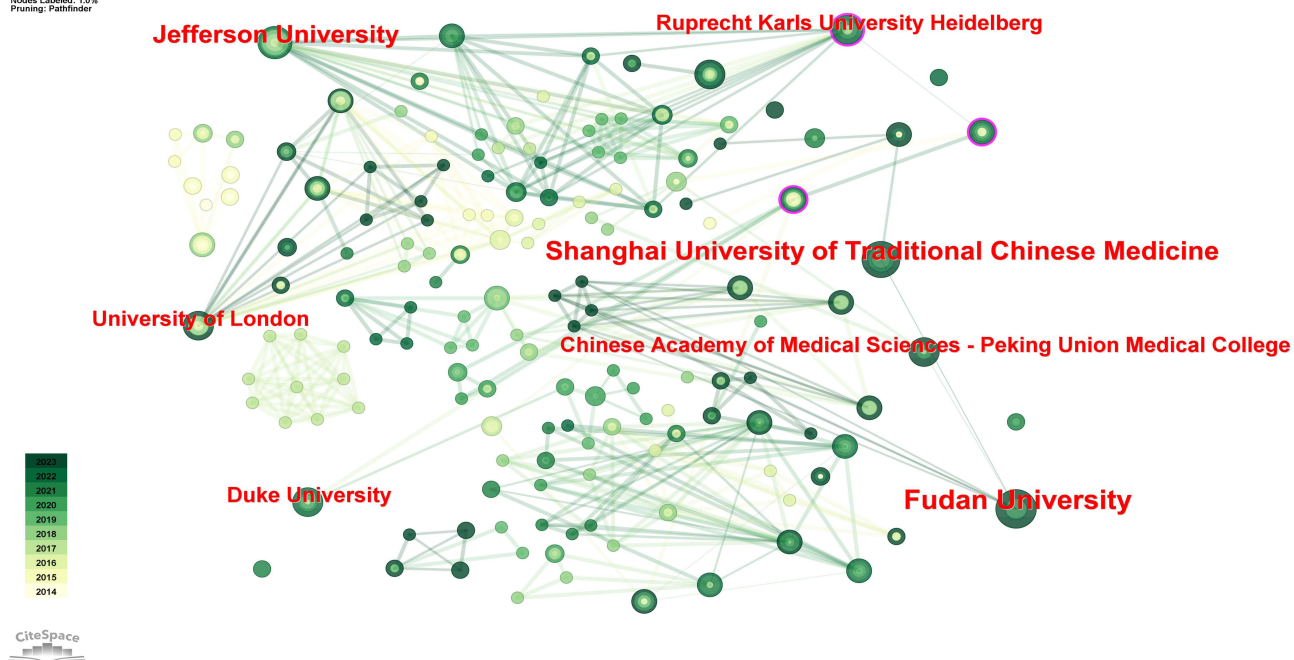


Figure 5 Map of institutions related to acupuncture for myopia.

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 Largest CCs: 502 (92%)
 Nodes Labeled: 1.0%
 Pruning: Pathfinder

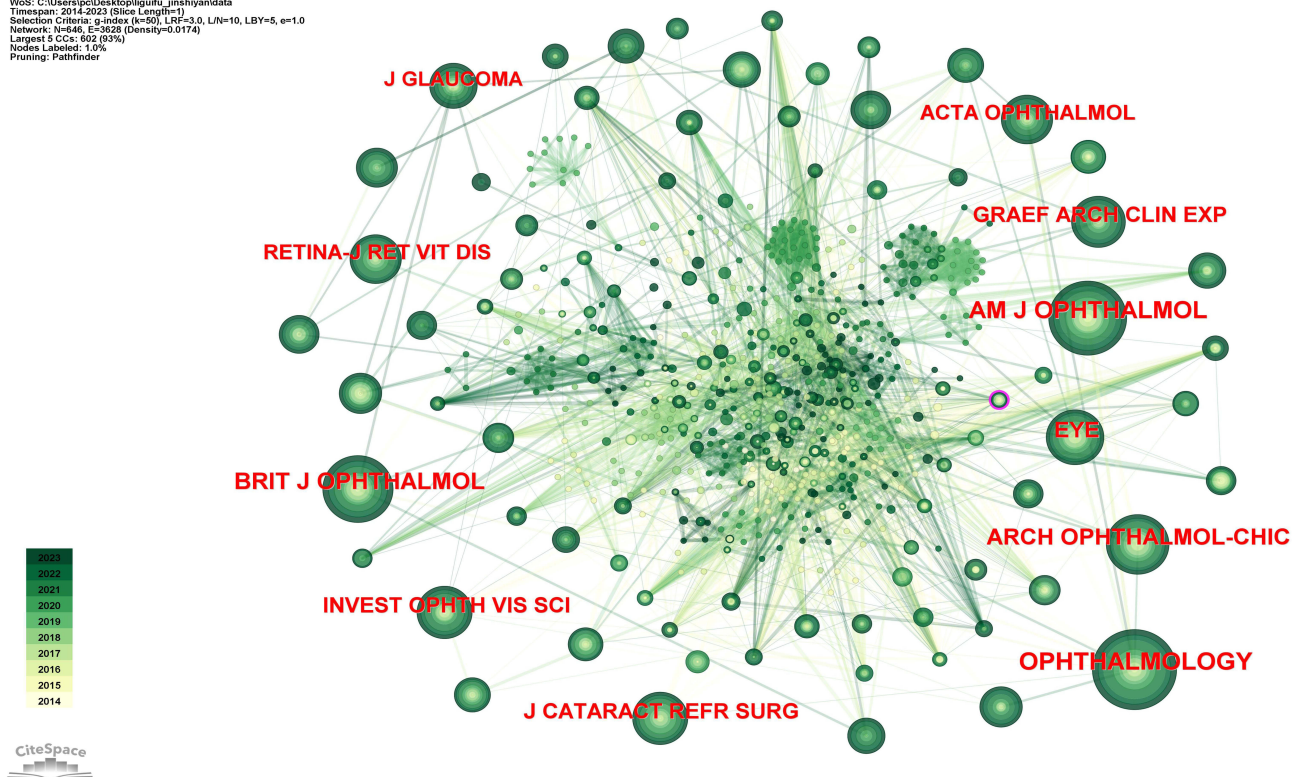


Figure 6 Map of cited journals related to acupuncture for myopia.

“acupuncture” and “therapy” exhibited higher burst intensities, reflecting the widespread recognition of acupuncture as a treatment for myopia in recent years.

Analysis of Keywords Timeline

Figure 9 presents a timeline graph of keywords arranged in chronological order. Alongside, on the right side of the figure, we have performed a cluster relationship analysis. This dual approach provides a comprehensive view, capturing both the temporal evolution of the keywords and the thematic clusters that have emerged in the field. This method aids in identifying the key areas of focus over time and how different themes are interrelated within the scope of acupuncture treatment for myopia. We observe that eight clusters are depicted, labeled with numbers 0 to 7. The first cluster (#0), marked as “dislocated plate”, focuses on topics like scleral fixation, IOL dislocation, and capsular defect. The second cluster (#1), labeled “risk factor”, concentrates on glaucoma surgery, invasive glaucoma surgery, and similar themes. The third cluster, denoted as “single eye”, emphasizes management, visual prognosis, filtration surgery, and related subjects. The fourth cluster, titled “clinical characterization”, highlights prevalence, Chinese children, eye exercises, and associated areas. The fifth cluster, marked as “macular edema”, is centered on retinal vein occlusion, alternative therapy, and macular edema.

Analysis of Dual Map Overlay of Reference

Figure 10 showcases the dual map overlay based on references. On the left side, the citing journals represent the cutting-edge knowledge frontier, while on the right, the reference journals symbolize the sources of foundational literature. In the diagram, the vertical axis of the ellipses indicates the number of papers, and the horizontal axis represents the number of authors. It is observed that in the field of acupuncture treatment for myopia, the developmental trajectory of the discipline is quite distinct, characterized by the integration of a single discipline (as depicted by the convergence of two grey thick

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 Largest CCs: 409 (88%)
 Nodes Labeled: 1.0%
 Pruning: Pathfinder

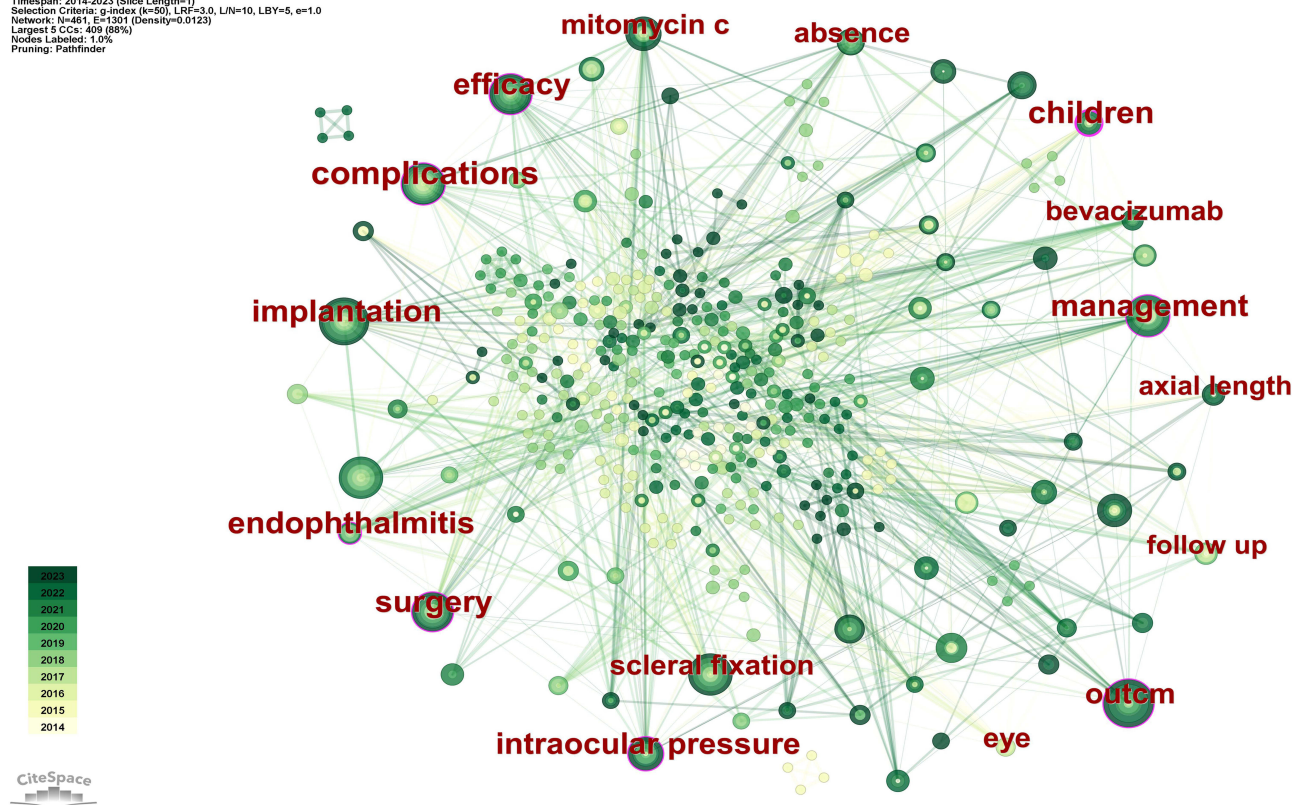


Figure 7 Map of keywords related to acupuncture for myopia.

lines into one area in the graph). This suggests a focused and unified approach within the field, demonstrating a clear and consolidated scholarly trajectory.

Discussion

This study employed CiteSpace to perform bibliometric analysis on the core authors, their collaboration networks, affiliated institutions, countries, and regions in the field of acupuncture treatment for myopia from 2014 to 2023. We have provided comprehensive data and identified research hotspots within the domain of acupuncture treatment for myopia.

General Information

This study demonstrates that in the field of acupuncture treatment for myopia, a total of 281 publications have been disseminated over the past decade. The trend line reveals a modest overall increase in the annual number of publications. The sharp decline in 2019 is linked to the global call for high-quality evidence in that year, while the significant surge in 2021 correlates with acupuncture's publication in the prestigious journal *Nature* and the release of China's "14th Five-Year National Eye Health Plan (2021–2025)". These developments reflect the increasing clinical application of acupuncture as a safe and effective complementary therapy for myopia.

Research Progress and Trends

Significant progress has been observed in certain areas of acupuncture research, particularly in understanding its mechanisms of action and the clinical outcomes for treating myopia. Studies have increasingly focused on the neurophysiological effects of acupuncture on eye muscle relaxation and visual acuity improvement, which has bolstered the evidence base supporting its use. However, there has been a decline in exploratory studies of traditional acupuncture mechanisms that lack biological validation, reflecting a shift toward more scientifically rigorous and evidence-based

Top 20 Keywords with the Strongest Citation Bursts

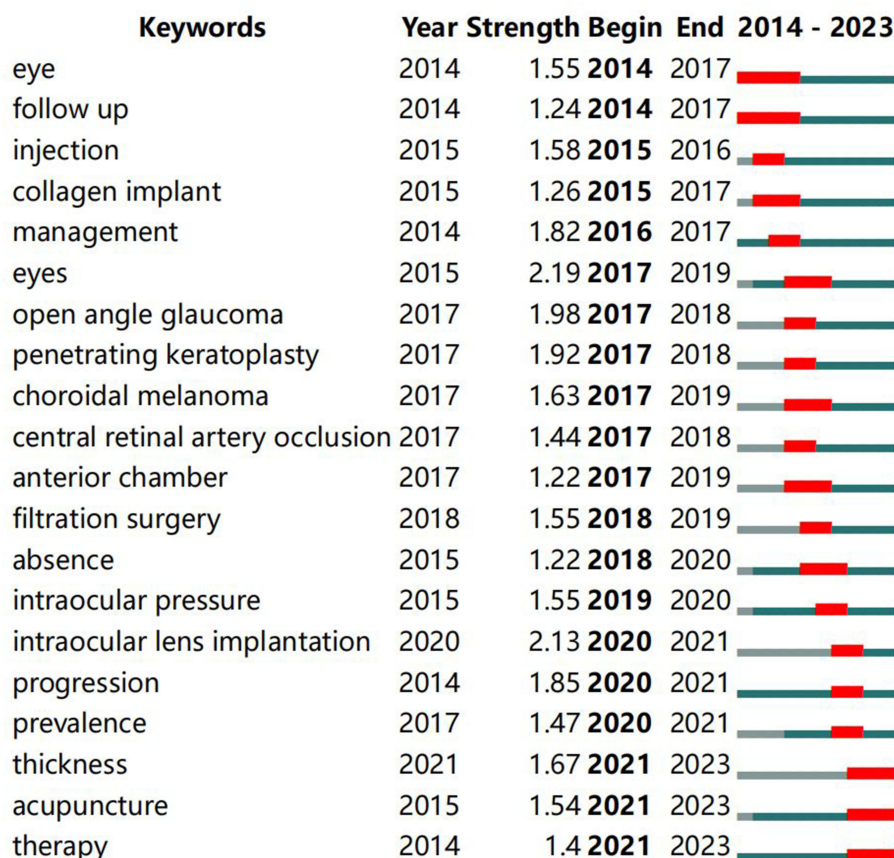


Figure 8 Top 20 keywords with the strongest citation bursts.

investigations. Current research is increasingly centered on examining the efficacy of acupuncture in specific patient populations and under various treatment protocols to optimize outcomes.

Mechanisms, Effects, and Techniques

Recent studies have revealed promising effects of acupuncture in regulating the autonomic nervous system and improving blood circulation in the eye region, both of which contribute to slowing myopia progression. Different acupuncture techniques have been employed in these studies, depending on the focus of the research. For instance, traditional body acupuncture targeting acupoints such as BL1 (Jingming) and ST1 (Chengqi) has been widely used in studies that emphasize improving visual acuity. Meanwhile, auricular acupuncture and electroacupuncture have been applied in studies exploring neural regulation and alleviation of eye strain. The diversity of techniques reflects both the flexibility and adaptability of acupuncture in addressing different aspects of myopia. Side effects of acupuncture are generally minimal and transient, such as minor discomfort or bruising, and no severe adverse reactions have been reported, further reinforcing its reputation as a safe therapeutic option.

Future Research Directions

There remains a significant gap in large-scale, multi-center clinical trials that provide high-level evidence of acupuncture's long-term efficacy in myopia treatment. Future research should focus on these types of studies, alongside further

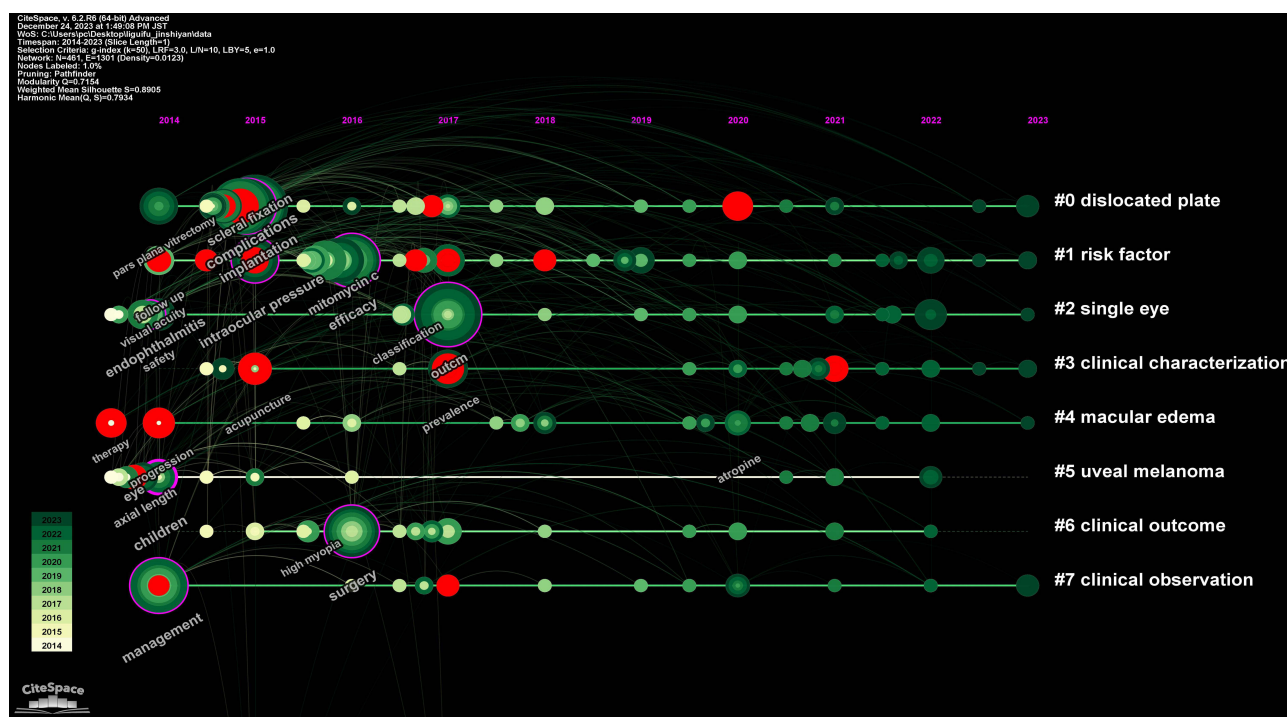


Figure 9 Map of keywords timeline related to acupuncture for myopia.

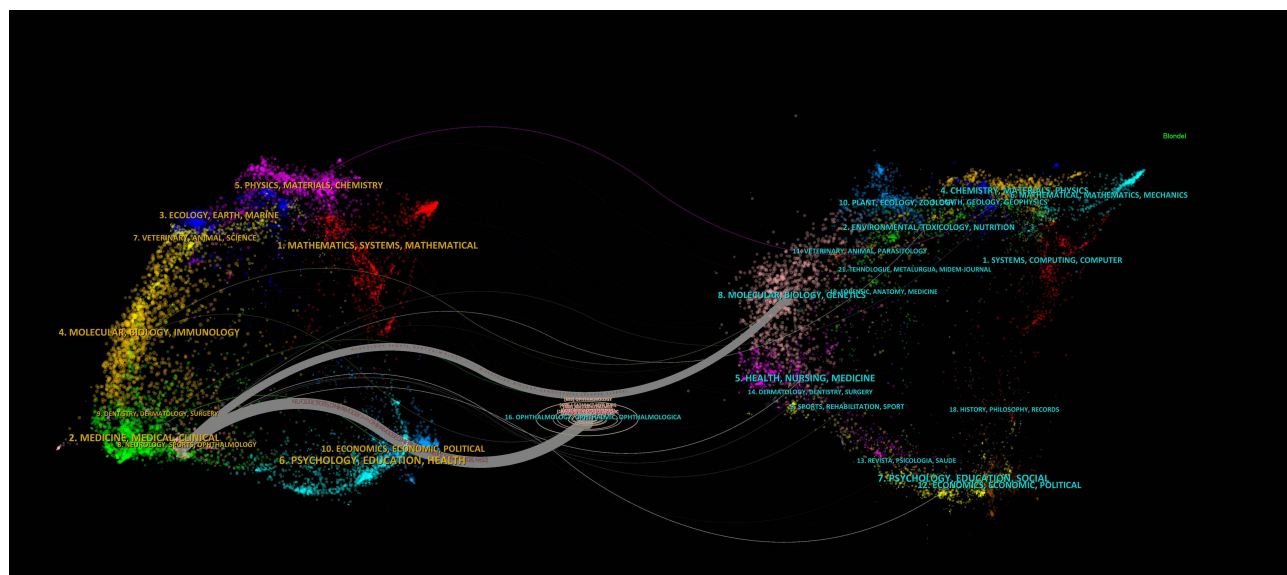


Figure 10 Dual map overlay of reference related to acupuncture for myopia.

exploration of the precise biological mechanisms underpinning acupuncture's effects on myopia progression. Additionally, there is a need for investigations into how acupuncture can be integrated into broader treatment plans, including its potential role in reducing the side effects of conventional therapies or enhancing their effectiveness. International collaboration is also critical for expanding the global application of acupuncture in myopia management, ensuring that findings are generalizable across diverse populations.

Research Hotspots

Keywords can unveil the core content and central themes of research within the field of acupuncture treatment for myopia. Through analyzing these keywords, we have identified two primary research hotspots in this domain: the clinical efficacy of acupuncture in treating myopia, and the mechanisms of action underlying acupuncture treatment for myopia. These hotspots highlight the key areas of focus and interest in the field, showcasing the depth and range of ongoing research efforts aimed at understanding and improving acupuncture as a treatment modality for myopia.

Clinical Efficacy of Acupuncture in Treating Myopia

Our findings indicate that acupuncture, as a distinctive complementary and alternative therapy, is widely used in China.²⁹ Clinically, it is often applied either as a standalone treatment or in conjunction with atropine. For instance, Mei³⁰ summarized through clinical experience that combining the acupoints Shangming, Jingming (BL1), Yiming, and Guangming (GB37) can effectively treat adolescent myopia. Chen³¹ and Li³² discovered that auricular acupressure not only yields good results but is also more readily accepted by children. Additionally, Liang³³ and Cheng³⁴ have achieved significant clinical effects by combining 0.25% and 0.125% atropine eye drops with auricular acupuncture. Interestingly, Kong³⁵ found that even 0.01% atropine combined with auricular acupuncture can produce satisfactory therapeutic effects. Therefore, we deduce that standalone acupuncture treatment for myopia has unique clinical efficacy and may not require the adjunctive use of other drugs.

Mechanism of Action in Acupuncture Treatment for Myopia

Review of literature suggests that acupuncture can regulate blood circulation in and around the eyes and affect the peripheral nervous system by stimulating specific acupoints, thereby improving ocular blood circulation and neural functions.^{19–21} A study have found that acupuncture modulates the development of myopia by reducing NLRP3 inflammasome activation via the dopamine-D1R signaling pathway.³⁶ Other research indicates that acupuncture at specific points (EX-HN5) can regulate brain electrical sensitivity in high-level cognitive brain regions to treat myopia.³⁷ Furthermore, a functional MRI study found that acupuncture stimulation activates the functional brain network of the brain's visual cortex, thereby producing a myopia-regulating effect.³⁸ These findings suggest that current research on mechanisms mainly revolves around local inflammatory mediators and the higher central regulation of the brain. In the future, it would be beneficial to supplement these findings with further studies on related molecular biological mechanisms.

Limitations

This study, like any research, has its limitations. First, the analysis was confined to publications within the WOSCC database, which means that important studies from other databases, such as Chinese and Korean sources, were not included. This could result in a partial representation of the global research landscape on acupuncture for myopia. Additionally, while CiteSpace is a powerful tool for visualizing trends and connections within the literature, it has its own limitations. For instance, CiteSpace does not easily allow for the integration of data from multiple databases, which could provide a more comprehensive analysis. Furthermore, its bibliometric analysis offers insights into research hotspots and trends but falls short in visualizing the underlying mechanisms and clinical outcomes of acupuncture treatment for myopia. These limitations highlight the need for future studies to employ more integrated and diverse databases, as well as complementary analytical tools, to gain a more holistic understanding of this research area.

Conclusion

The high prevalence and early onset of myopia, coupled with the absence of specific curative treatments, have necessitated the search for safe and effective complementary and alternative therapies. Acupuncture, with thousands of years of application in China, has shown its unique therapeutic effects in treating myopia. Currently, the most focused research hotspots are the clinical efficacy of acupuncture in treating myopia and the mechanisms of action underlying this

treatment. In the future, there is a need to further supplement with large-scale, multi-center randomized controlled trials (RCTs) and additional explorations into the relevant mechanisms.

Abbreviations

WOSCC, Web of Science Core Collection; SCI-E, Science Citation Index-Expanded; WHO, World Health Organization; RCTs, randomized controlled trials.

Data Sharing Statement

The raw data can be directly obtained from the WoSCC, and further inquiries can be directed at the corresponding author.

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Disclosure

The authors declare that they have no potential conflicts of interest in this study.

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