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ORIGINAL RESEARCH

Bibliometric and Visual Analysis of the Status of Scleral Lens Research Based on the Web of Science Database and Scopus Database (2014-2024)

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Objective: To examine the current status of research, identify key areas of interest, and explore emerging frontiers in the field of scleral lenses (SL) with the goal of informing and advancing further research in this field.

Methods: Bibliometric methods were utilized to retrieve SL-related literature published in the Web of Science and Scopus database from 2014 to 2024. Elements such as authors, country/region, institution, journal, and keywords were analyzed using CiteSpace information visualization and analysis software and Bibliometrix R package.

Results: A total of 506 articles were included. Among 117 countries/regions, the United States ranked first in the number of publications, followed by Spain and Australia. The distribution of research institutions showed that the Queensland University of Technology had the largest number of publications. Prof. Schornack, MM from Mayo Clinic had the highest number of articles. The research literature on SLwas published in 184 journals, of which *Contact Lens & Anterior Eye* and *Eye & Contact Lens: Science and Clinical Practice* were the most influential. Keyword clustering mainly included corneal topography, dry eye, limbal stem cell deficiency, ocular surface disease.

Conclusion: SL has emerged as a prominent area of investigation in the field of ophthalmology. In this study, the research field of SL from 2014 to 2024 was visualized and analyzed, providing a visualization of the development status of SL and revealing the trends and cutting-edge hotspots of SL-related research. SL exhibits a broad spectrum of applications and demonstrates considerable potential for enhancing both visual acuity and overall quality of life in patients afflicted with diverse ocular conditions. This study offers a comprehensive overview of current state of knowledge and understanding on SL for researchers and clinicians.

Keywords: scleral lens, bibliometrics, literature visualization, research hotspots

Introduction

Scleral lenses (SL) were first blown from glass at the end of the nineteenth century to restore vision and protect the ocular surface.[1–3] Polymethyl methacrylate material was introduced in the 1930s. Compared to glass, it had more advantages in adaptability and plasticity, which led to the further development and application of SL. However, the low oxygen permeability of the polymethyl methacrylate material made it prone to corneal hypoxia symptoms.[4–6] In the 1980s, rigid, high-permeability contact lens materials appeared. With the advancement of ocular imaging technology and improvements in lens manufacturing processes, the safety and comfort of SL have improved, resulting in a significant increase in wearing time.

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SL is a large-diameter, rigid, gas-permeable corneal contact lens that can be used for a variety of ocular surface disorders, such as keratoconus, severe dry eye, neurotrophic keratitis, residual high refractive error after keratoplasty, and irregular corneal surface.[7,8] SL is lighter and thinner, with a well-positioned center, making it easier to fit. When other methods are ineffective, SL can be used as an auxiliary means of traditional treatment or as an alternative treatment after the failure of traditional treatment. SL has two unique features: the lens lands on the sclera and does not directly contact the cornea, and the area between the lens and the cornea is filled with a constant amount of tear fluid/saline. This helps neutralize most of the irregular astigmatism of the cornea. Furthermore, the filler fluid can replenish water for the cornea, promoting the healing of ocular surface damage and protecting the cornea from the influence of eyelid friction during blinking.[9,10] SL can also be used as a carrier for drug delivery to increase drug concentration.[9,10] SL are rotationally stable due to their minimal movement during blinks. A reflective telescope system embedded in the SL has been developed, and this system has potential applications in military and low vision rehabilitation.[11–13] With increasing awareness of visual and eye health, as well as the widespread attention of professionals in ophthalmology and optometry, the popularity of SL has been increasing.

Nevertheless, the issue of oxygen permeability associated with SL wear warrants careful consideration. The use of SL can result in a compounded hypoxic effect due to the lens and its fluid reservoir thickness, potentially leading to central corneal edema.[14] This presents a notable risk to patient health, particularly with prolonged use. The cost of manufacturing and fitting SL is high. The fitting process of the SL is more complicated than that of the general contact lens, which requires more precise measurement and adjustment. This increases the difficulty and time of matching the SL, and may also limit its application in a wider user group. SL can improve the quality of life of patients with astigmatism after penetrating keratoplasty as well as keratoconus due to the comfort and vision they provide.[15] However, midday fogging is still a problem for many SL wearers.[16]

This study utilizes bibliometric analysis and Citespace visualization software, based on the Web of Science (WOS) database and Scopus database, to sort out the relevant research literature on SL in the last decade. The goal is to analyze the current situation and hotspots of SL research in order to help researchers understand the development trend, distribution, and core topics of SL. Moreover, the analysis aims to promote cooperation and communication among international researchers as well as the application of new technologies in SL-related fields to solve the challenging problems related to SL.

Methods

Data Acquisition

The Web of Science Core Collection database and Scopus database was the source of relevant data for this study. The literature was selected by entering the key descriptions: "scleral lenses", "scleral lens", "scleral contact lenses", "scleral contact lens", "prosthetic replacement of the ocular surface ecosystem". The retrieval period was limited to 2014–01-01 to 2024–12-26, the type of screening literature was limited to "Article". The WOS index was "Science Citation Index Expanded (SCI-EXPANDED)". In addition, manual screening was conducted to remove irrelevant literature and case reports. We merge and de-duplicate the articles retrieved from these two databases. Figure 1 illustrates the study screening process.

Evaluation Indicators

In this study, indicators such as annual number of publications, keyword co-occurrence, keyword clustering, keyword mutation/burst, keyword timeline, country/region distribution, institution distribution, author publication volume, distribution of journals of publications, literature co-citation, and clustering were used to understand the research trend of SL.

Data Analysis and Visualization

Bibliometric analysis was used to obtain quantifiable objective data and then presented trends and hotspots in the field of SL research. Information on SL-related literature from 2014 to 2024 was obtained from the Web of Science (WOS)

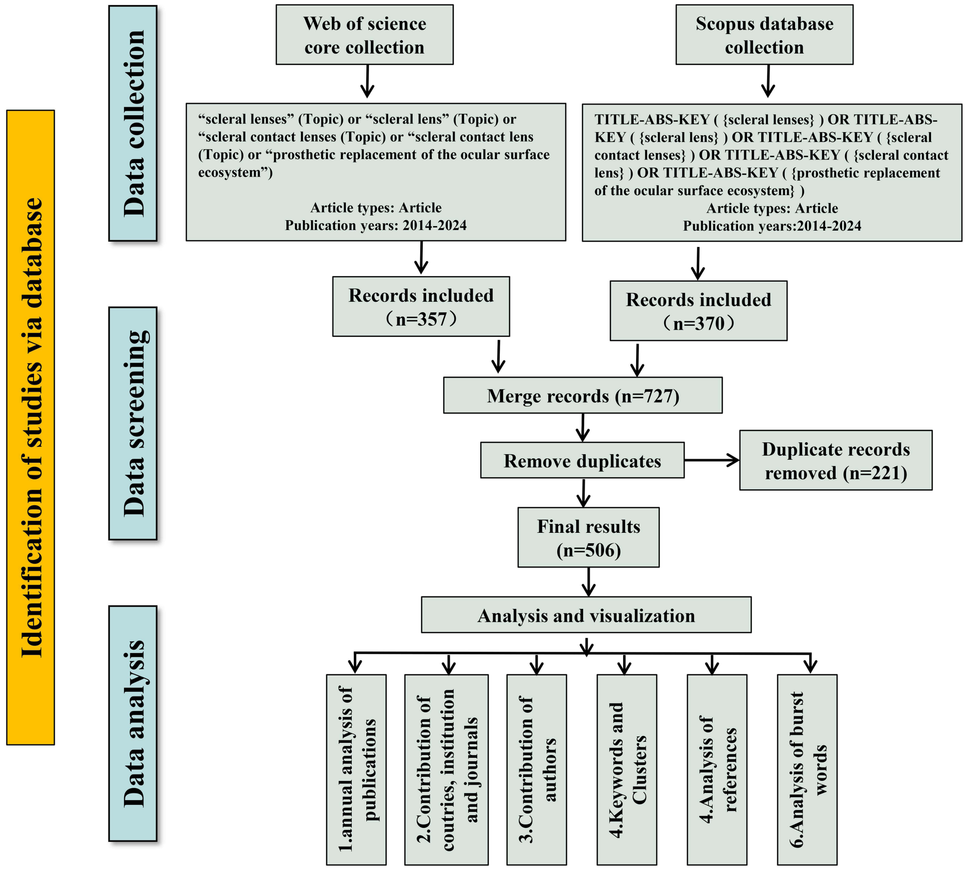

Figure 1 The retrieval strategy and data analysis process of this study.

database and Scopus database. The annual number of publications was counted using Citespace software. Keywords, country/region and institution distribution, and literature co-citation were visualized using Citespace software, and centrality (status and importance of the academic research field) was calculated. The time span was set from 2014 to 2024, and the threshold was "k = 25". The total number of citations for authors, journals, and institutions were obtained also by using Citespace software. H-index of authors was obtained from WOS database. The frequency distribution of science productivity and Sankey diagram were analyzed by using the Bibliometrix R package. The annual publication data was visualized by using Microsoft Excel. An exponential function, ($F(x) = ae^{bx}$), was utilized to model the cumulative growth trend of publications.

Results

Annual Publications

A total of 506 SL-related publications were retrieved from the WOS and Scopus database, and the annual number is shown in Figure 2. There was a steady increase in the number of publications from 2014 to 2020, with the largest number (81) in 2020, and the number of publications decreased from 2021 to 2024. Figure 3 illustrates the exponential increase (dotted line) in SL publications from 2014 to 2024, with exponential growth curve ($y = 28.348e^{0.2957x}$, $R^2 = 0.9$).

Country/Region Distribution

In the last decade, SL-related literature has covered 117 countries and regions. The top ten countries with the highest number of publications are the United States, Spain, Australia, India, the Netherlands, Canada, Portugal, Turkey, France, and China (Table 1). From 2014 to 2024, the United States published the highest number of articles, with 1753 articles (centrality: 0.29), followed by Spain (53 articles) and Australia (43 articles,). This indicates that the United States, Spain,

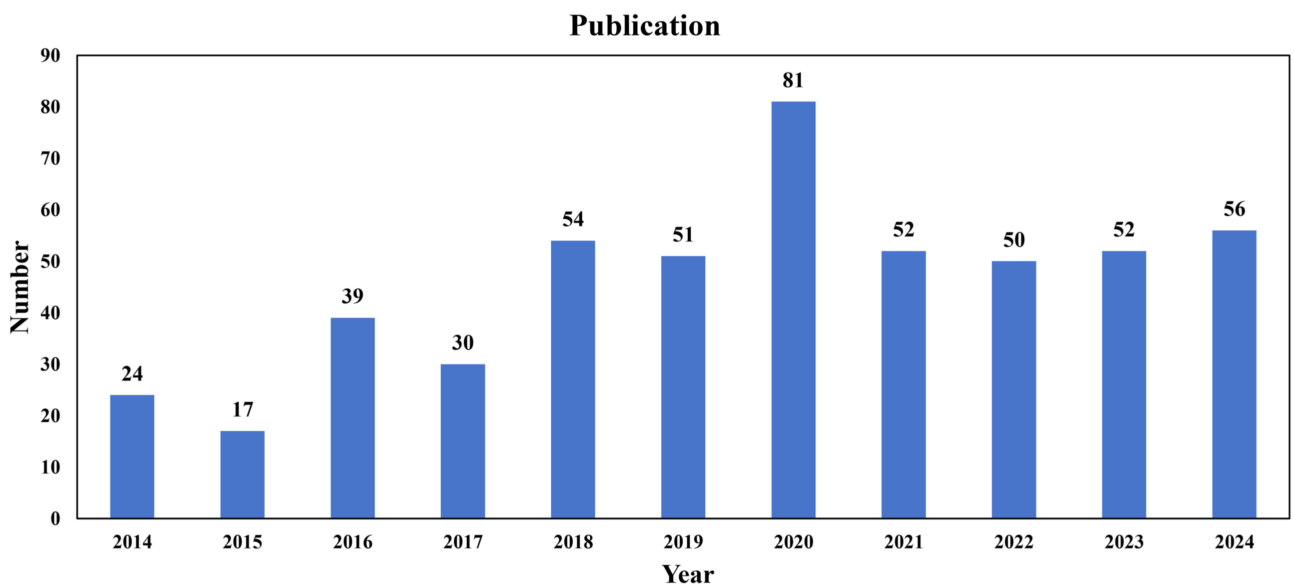

Figure 2 Distribution of annual publications in scleral lens-related literature, 2014–2024.

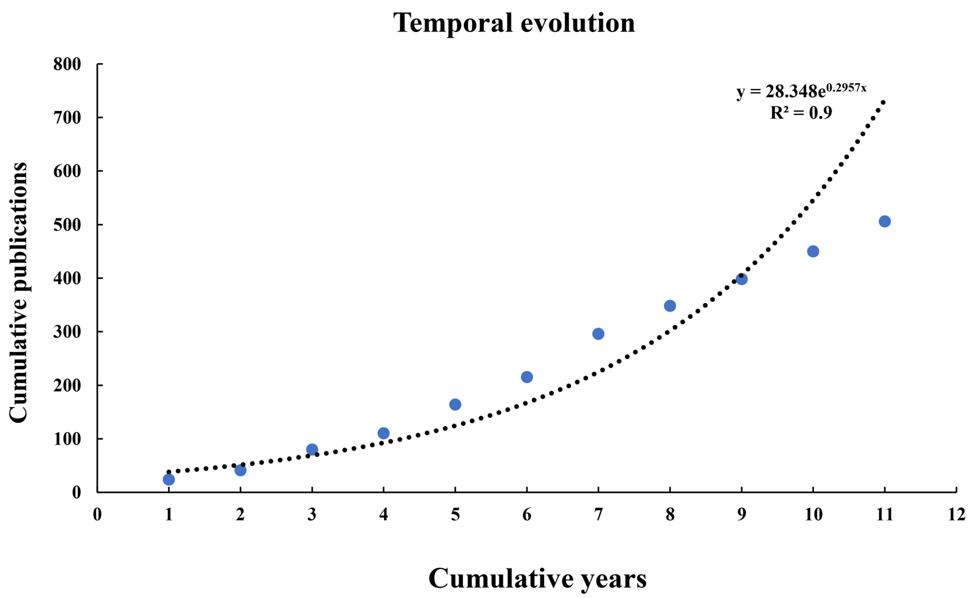

Figure 3 Cumulative publication trends in publication output of articles on scleral lens, 2014–2024.

and Australia are the main forces in the field of SL research. Visualizing the cooperation between countries/regions using Citespace software (Figure 4A), where the lines represent partnerships, it is clear that the United States works most closely with other countries, acting as a bridge. The term "MCP" refers to the count of publications co-authored by researchers from multiple countries, whereas "SCP" denotes the number of publications co-authored by researchers within the same country. It is observed that the majority of countries predominantly engage in domestic academic collaborations, with international exchanges and collaborations being comparatively infrequent (Figure 4B).

Active Institutions

The analysis of active institutions aims to understand the global distribution of SL-related research, thereby facilitating cooperation and exchange between institutions and regions. A total of 1064 research institutions were involved in the SL-

Table 1 Top 10 Countries/Regions in Terms of Number of Literatures Related to Scleral Lenses, 2014–2024

Number	Country/Region	Articles	Centrality
1	USA	175	0.29
2	Spain	53	0.14
3	Australia	43	0
4	India	43	0.06
5	Netherlands	24	0.17
6	Canada	23	0
7	Portugal	23	0.06
8	Turkey	21	0
9	France	18	0
10	China	18	0.06

related literature published from 2014 to 2024. As shown in Figure 5, the size of the circle is proportional to the competitiveness of research institutions in SL research. The larger the circle, the more competitive the research institutions are, indicating that these institutions have conducted more research in recent years. According to the data (Table 2), the Queensland University of Technology, Mayo Clinic, and University of Illinois at Chicago were among the top three institutions in terms of both the number of articles published and the number of citations in the field of SL research, indicating their substantial influence on SL research.

Journal Analysis

From 2014 to 2024, SL-related literature was disseminated across 184 academic journals. Table 3 provides the number of articles and total citations from the top 10 journals. Among them, *Contact Lens & Anterior Eye, Eye & Contact Lens-Science and Clinical Practice*, and *Cornea* emerged as the top three journals in terms of the number of articles published, with 101, 100, and 96 articles, respectively. The impact factors of these three journals are 4.1, 2, and 1.8, with category quartile of Q1, Q2, and Q2, respectively. Among the top 10 journals in the number of publications, *Ophthalmology* had the highest impact factor of 13.2. A total of 69 journals published one article each, while 41 published two articles each during this period.

Analysis of Authors

Table 4 shows the top 10 authors with the highest number of publications. During the period 2014–2024, Professor Schornack, MM, from Mayo Clinic in USA, had the highest number of 43 publications, followed by Professor Vincent, SJ, from Queensland University of Technology (QUT), with 37 articles. Professor Michaud, L, from the Universite de

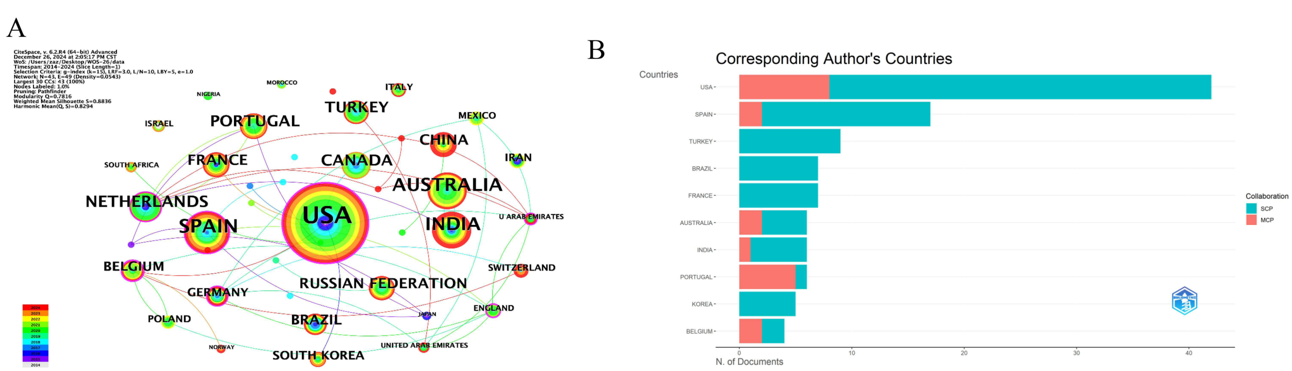

Figure 4 Scleral Lens National/Regional Collaborative Network (**A**). Analysis of cooperation in the author's country (**B**), SCP: single country publications (green); MCP: multiple country publications (red).

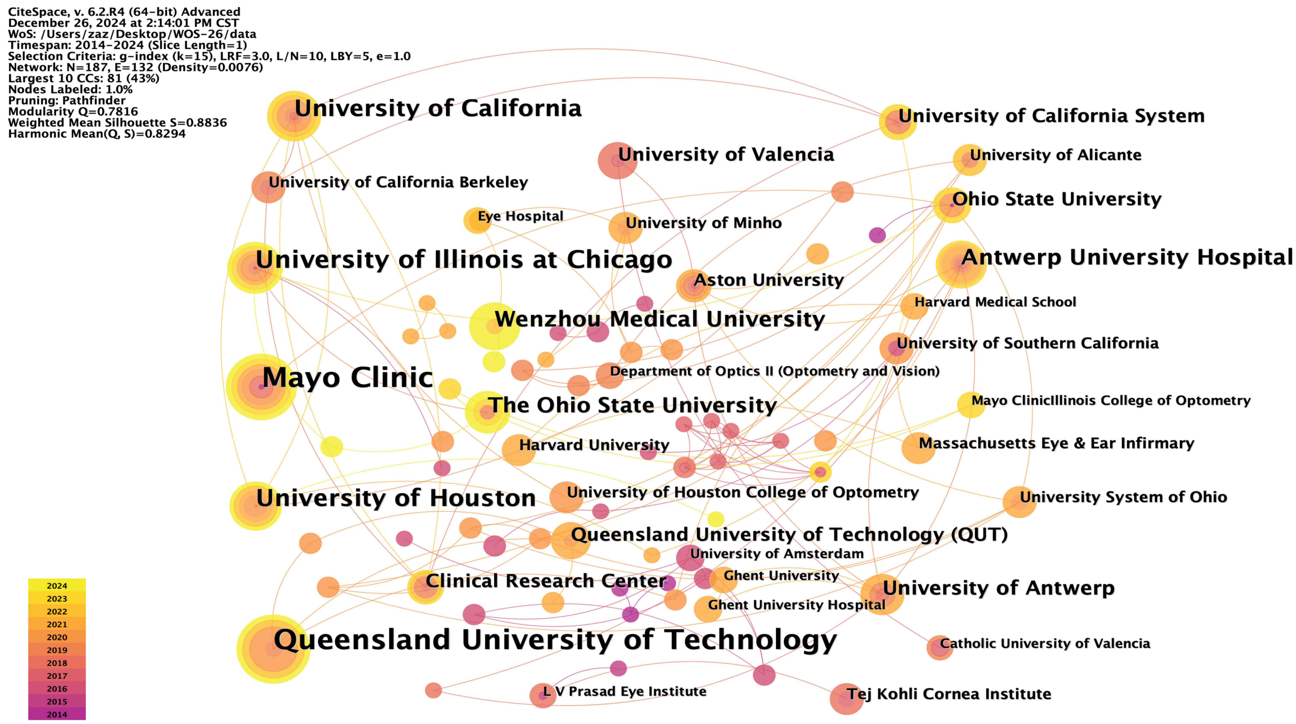

Figure 5 Distribution map of scleral lenses research institutions from 2014 to 2024.

Montreal, ranked third, with 34 articles. The H-index evaluates a scholar's academic reputation and influence by considering both their number of publications and citations, offering a more meaningful measure than simply counting citations or publications. The top three authors with the highest H-index were Professor Vincent, SJ (36), Walker MK (21) and Nau, CB (18). This study shows the relationship between authors, countries, and keywords by using the Bibliometrix R package to create Sankey diagram (Figure 6). Figure 6 shows that authors who published SL-related publications were mainly from developed countries in Europe and the United States, and the keywords were mainly: keratoconus, scleral lens, ocular surface disease. As shown in Figure 7, 913 authors (70.12%) had written just one document. In this study, the frequency distribution of science productivity related to SL from 2014 to 2024 is consistent with Lotka's law.

Table 2 Top 10 Institutions in the Number of Scleral Lenses Manuscripts Published in 2014–2024

Number	Institution	Articles	Country
1	Queensland University of Technology	20	Australia
2	Mayo Clinic	19	USA
3	University of Illinois at Chicago	13	USA
4	University of Houston	12	USA
5	University of California	11	USA
6	Antwerp University Hospital	9	Belgium
7	Wenzhou Medical University	9	China
8	Complutense University of Madrid	8	Spain
9	The Ohio State University	8	USA
10	University of Antwerp	7	USA

Table 3 Top 10 Journals of Scleral Lenses Published from 2014 to 2024

No.	Journals	Articles	Journal Impact Factor	Journal Citation Indicator	Category Quartile
1	*Contact Lens & Anterior Eye*	101	4.1	1.74	Q1
2	*Eye & Contact Lens-Science and Clinical Practice*	100	2	0.86	Q2
3	*Cornea*	96	1.9	1.09	Q2
4	*American Journal of Ophthalmology*	87	4.1	2.02	Q1
5	*Optometry and Vision Science*	86	1.6	0.66	Q3
6	*Investigative Ophthalmology & Visual Science*	70	5	1.62	Q1
7	*Ophthalmology*	69	13.2	5.16	Q1
8	*Clinical and Experimental Optometry*	52	1.7	2.66	Q3
9	*Journal of Cataract and Refractive Surgery*	48	2.6	1.32	Q2
10	*British Journal of Ophthalmology*	47	3.8	1.93	Q1

Table 4 Top 10 Authors in Scleral Lenses Publications, 2014–2024

Number	Authors	Articles	H-index	Institution
1	Schornack, MM	43	16	Mayo Clinic
2	Vincent, SJ	37	36	Queensland University of Technology
3	Michaud, L	34	13	Universite de Montreal
4	Van Der Worp, E.	27	16	Eye-Contact-Lens Research & Education
5	Rathi VM	27	17	L. V. Prasad Eye Institute
6	Pullum KW	22	8	Moorfields Eye Hospital
7	Walker MK	20	21	University of Houston
8	Severinsky B	20	5	Emory University School of Medicine
9	Barnett M	18	10	University of California
10	Nau, CB	18	21	Mayo Clinic

Keyword Analysis

Keywords function as a succinct representation of the content of SL research papers, enabling the analysis at the forefront of research. In this study, words with synonymous meanings were merged, and the utilization of Citespace software revealed (Figure 8A) that the ten most frequently occurring keywords were "scleral lens", "human", "article", "sclera", "visual acuity", "keratoconus", "cornea", "physiology", "prosthesis fitting", and "optical coherence tomography". The interconnected lines between various keywords in Figure 6A signify their co-occurring relationships.

Keywords were clustered based on research direction (Figure 8B), with the top five clusters identified as corneal topography, dry eye syndrome, dry eye, limbal stem cell deficiency, ocular surface disease. These clusters were interconnected and overlapped, suggesting a close relationship and interdisciplinarity in the research directions. The keyword timeline mapping (Figure 8C) illustrates the temporal evolution of the most frequently occurring keywords within each cluster. The earliest appearing and most prominent keywords identified in this study was astigmatism, graft-versus-host disease, vision.

Keywords in the burst value denote a notable surge in the frequency of keyword occurrences within a brief timeframe and serve as a tool for promptly discerning current research trends and identifying novel avenues for research. Figure 9 shows the top 25 keywords with the strongest citation bursts. The red portion of the time bar shows when the keyword bursts began and ended. In 2014, scholars focused on the use of SL in corneal transplantation and the treatment outcome.

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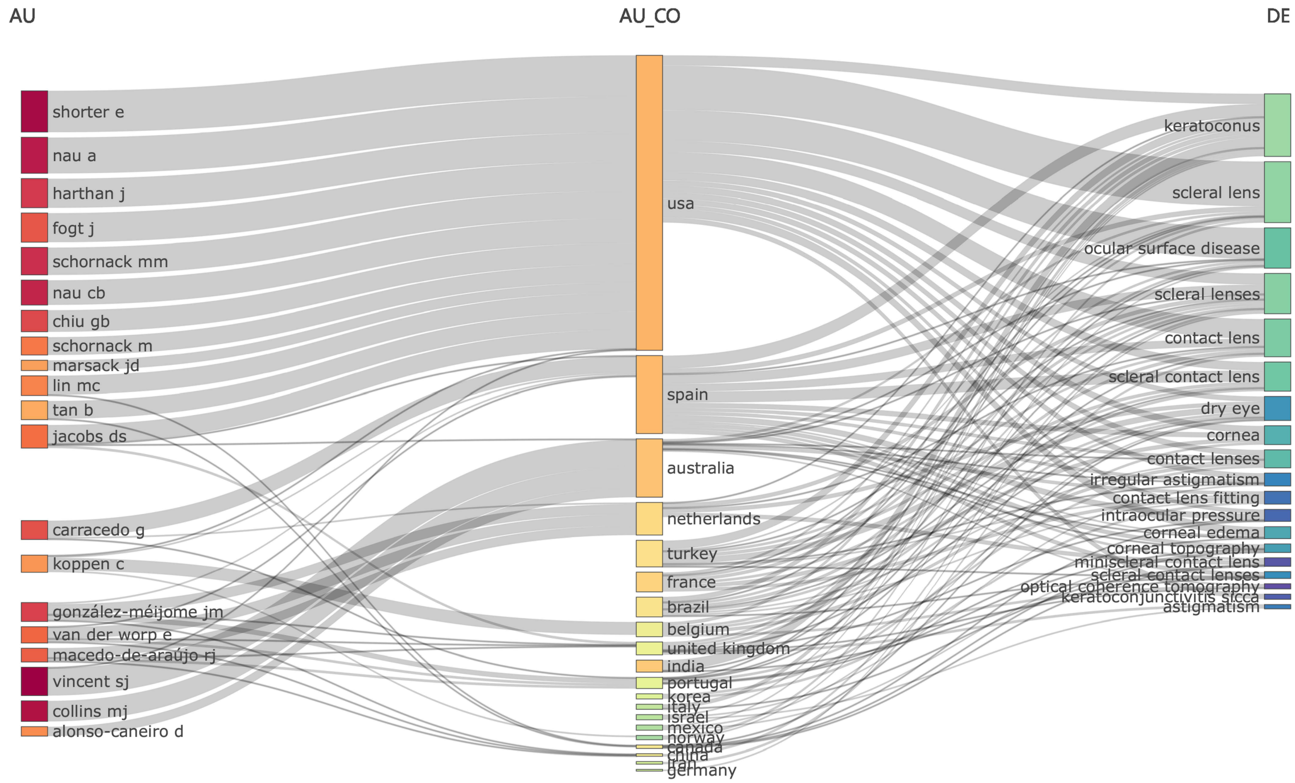

Figure 6 Sankey diagram of authors, countries, and keywords in published literature related to scleral lenses, 2014–2024. Sankey diagrams show the flow of data, the lines represent the flowing data and the nodes represent the different categorizations. AU: authors; AU_CO: countries; DE: keywords.

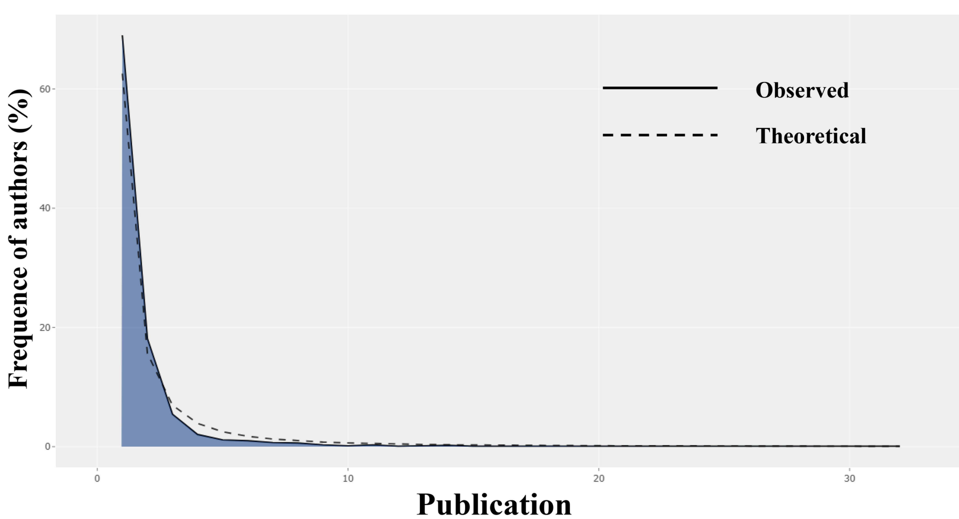

Figure 7 The frequency distribution of science productivity related to scleral lenses, 2014–2024.

Subsequently, SL began to be used in dry eye and refractive error, focusing on the complications, adverse effects, and patient satisfaction of SL.

Co-Cited Reference Analysis

In this study, a co-citation network analysis of references cited in papers from 2014 to 2024 was conducted to explore their significance in the SL research field. Figure 10A displays the authors and years of cited references. The most cited paper was “Modern scleral contact lenses: A review”, published by Prof. van der Worp, ED, in 2014,[17] followed by

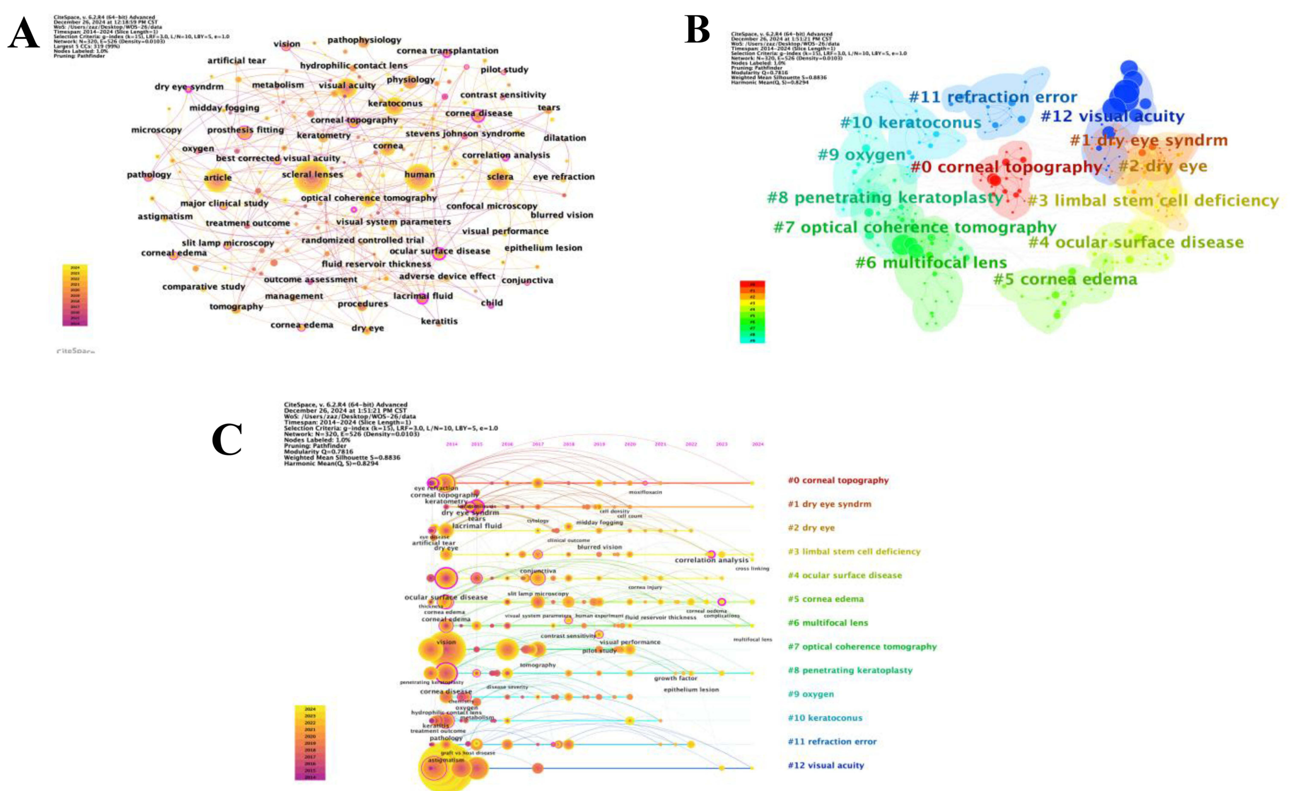

Figure 8 Keyword analysis related to scleral lenses from 2014–2024. (**A**) Keyword co-occurrence mapping, node size indicates frequency; (**B**) Keyword clustering mapping, different colors represent different clusters; (**C**) Keyword timeline view. Each horizontal line represents a cluster, the smaller the number the larger the cluster, the largest cluster is #0, the node size responds to the frequency of co-citation, the relationship between the nodes indicates the co-citation relationship, and the year of node occurrence is the first time it was co-cited.

"Scleral Lenses Reduce the Need for Corneal Transplants in Severe Keratoconus" published by Prof. Koppen C, in 2018.[18] "Complications and fitting challenges associated with scleral contact lenses: A review" published by Prof. Walker, MK, ranked third in 2016.[19]

Co-cited references were categorized into clusters based on the level of correlation, each represented by different colors (Figure 10B). The top five clusters from most to least published articles were #0 corneal degeneration, #1 corneal edema, #2 central corneal clearance, #3 irregular cornea, #4 miniscleral contact lens. As shown in Figure 10B, clusters #1, #2, and #7 are focused on adverse reactions that occurred while wearing scleral lenses.

Discussion

In this paper, an in-depth analysis of SL-related literature published in the WOS database from 2014–2024 was conducted. And visualization software was employed to analyze trends, hotspots, and frontiers of SL research over the past decade, with the aim of helping researchers extract useful information from complex data and offering additional insights to clinicians and scholars. Currently, publications on SL are predominantly focused on developed nations, with the United States leading in contributions and playing a significant role in collaborative networks. I Corneal limbal stem cell deficiency, dry eye, ocular surface disease, and corneal edema are research hotspots in this field, which may serve as key areas for future investigation.

The analysis of country/region distributions helps clinicians to understand the research status of SL-related fields. Two important evaluation indicators are the number and centrality of publications. A high level of centrality indicates that certain countries and regions serve as crucial connectors within the global collaborative network. Among the top 10 countries in terms of publication output from 2014 to 2024, there were 2 countries in the Americas, 5 in Europe, 2 in Asia, and 1 in Oceania. The predominance of high-quality SL research outcomes from developed nations underscores the

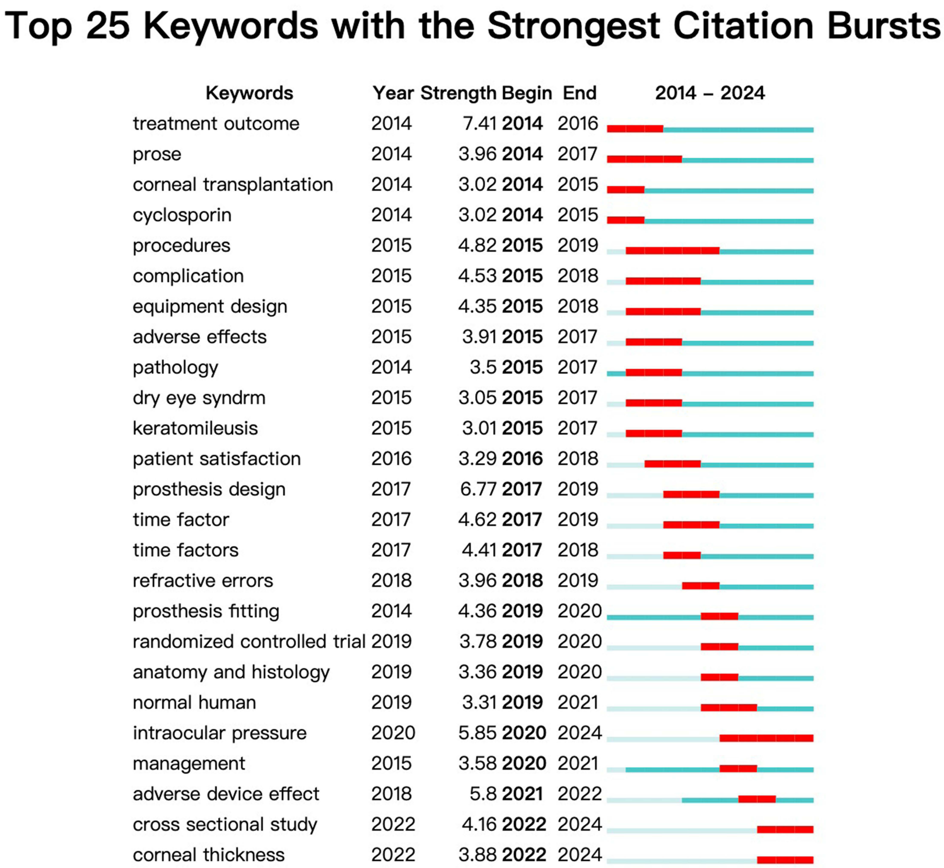

Figure 9 Keywords in the burst value of scleral lenses from 2014 to 2024. The red bar represents the keywords with higher co-citation in this time period.

disparity between these countries and low-/middle-income countries ((LMICs)) in healthcare and scientific research. This gap is not only evident in the availability of advanced healthcare technologies but also in the capacity for conducting and applying research findings to improve health outcomes in LMICs. The lack of targeted research funding and relevant in-country research capacity in LMICs exacerbates the challenges faced in addressing health issues locally. This highlights the need to strengthen international cooperation to address these gaps. By engaging in collaborative learning, establishing joint research initiatives, and developing standardized practices that incorporate global expertise, the field of SLcan endeavor to bridge existing gaps and enhance therapeutic outcomes for patients on a global scale.

The United States leads globally in the volume of international collaborative publications and functions as a pivotal nexus for national cooperative efforts. The United States holds the top position in terms of the number of published papers and is the central country for SL research. Six of the top 10 institutions in this field are situated in the United States, indicating that the United States plays a significant role in SL research and is actively involved in international collaborations. The prominent position of the United States can be attributed to the valuable contributions made by esteemed research institutions, such as the Mayo Clinic and the University of Illinois at Chicago.

From 2014 to 2024, 184 journals published SL-related research, with 33 journals publishing over ten articles, making up 17.9% of the total. *Contact Lens & Anterior Eye* had the highest number of articles. The impact factor has emerged as a globally recognized metric for evaluating journals. It serves not only as an indicator of a journal's utility and visibility but also as a crucial measure of its academic standing and the quality of the articles it publishes. *Ophthalmology* has the highest impact factor (13.2). High-quality journals play a crucial role in guiding the clinical development of SL by offering a platform for disseminating evidence-based research and best practices. High-quality journal literature provides detailed methodologies and findings that can be used to refine clinical practices, and is an example of how high-quality

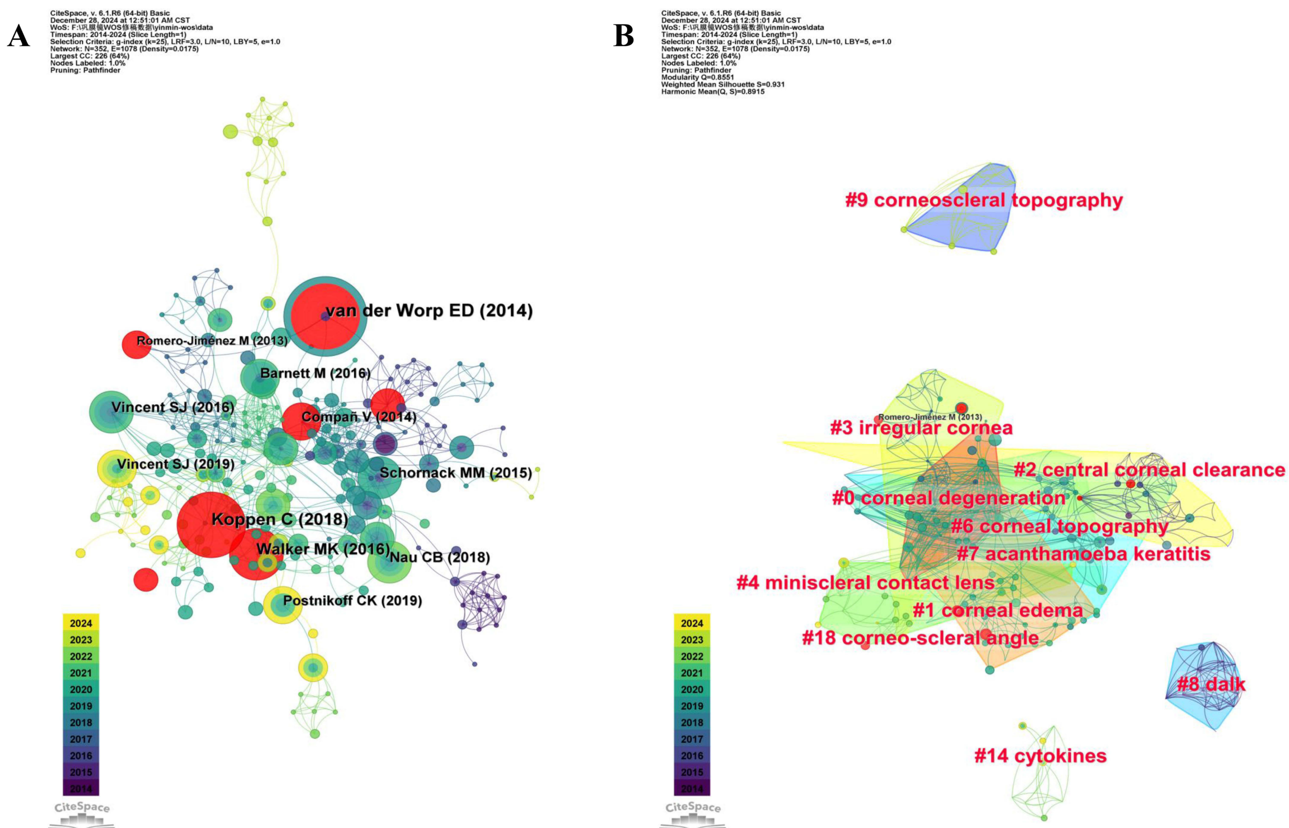

Figure 10 Analysis of references related to scleral lenses. (**A**) Map analysis of co-cited literature. Node size is proportional to the number of cited references. (**B**) Clustering of cited references based on similarities between them.

evidence can strengthen clinical guidelines. However, there is a lack of high-quality papers on SL, particularly in prospective studies.

Professor Schornack, MM, held the highest number of publications, in SL field from 2014–2024. Professor Schornack, MM showed that patients wearing SL experience midday fogging, leading to blurred vision, which may be due to increased turbidity of fluid reservoirs or deposits on the anterior and posterior surfaces of the lens.[20] To minimize midday fogging, patients need to remove, rinse, and re-wear their SL periodically throughout the day. However, this results in an additional burden of care for the patient. The H-Index is formulated to evaluate the academic reputation and influence of researchers by considering both the quantity of their publications and the impact of those publications. In evaluating the scholarly contributions of researchers, the H-Index provides a more comprehensive and academically meaningful assessment compared to simpler metrics such as the total number of citations or the total number of publications. Among the top ten authors ranked by publication volume, Professor Vincent, SJ possesses the highest H-index of 36, underscoring their status as one of the most influential scholars in the field of SL. Professor Vincent, SJ, and his team primarily focused on the impact of SL wear on various aspects of ocular health. Specifically, they studied curvature, optics, intraocular pressure,[21,22] changes in corneal edema,[23] and the effects on ocular anatomy and physiology.[24] In addition, they have researched the use of SL in penetrating keratoplasty[25] and post-LASIK corneal ectasia.[26,27] The research conducted by Michaud L's team demonstrated that optometrists are capable of assessing SL after 30 minutes of wear and can accurately estimate the residual fluid volume post-lens stabilization by doubling the initial measurement.[28] Professor Macedo-de-Araújo, RJ discovered that long-term SL wear does not affect corneal biomechanical parameters or intraocular pressure after lens removal.[29] They also found that wearing time did not impact goblet cell density or secretion.[30] In addition, they also used a Cobra fundus camera to evaluate changes in meibomian glands in SL wearers.[31] The research conducted by these scholars on SL provides guidance for its clinical application.

Keyword clustering analysis revealed that the key research areas associated with SL use are corneal topography, dry eye syndrome, dry eye, limbal stem cell deficiency, ocular surface disease. The evolution of the research focus can be observed through the keywords with the citation bursts, with early studies concentrating on the utilization of SL in treatment outcome (2014–2016) and prosthetic replacement of the ocular surface ecosystem (prose) (2014–2017). Subsequent research has shifted toward investigating equipment design (2015–2018), dry eye syndrome (2015–2017), patient satisfaction (2016–2018). The emphasis on the safety of wearing SL has been progressively highlighted, as evidenced by the frequent appearance of key terms such as Intraocular pressure (2020–2024), and corneal thickness (2022–2024). Several studies have investigated how SL wear affects intraocular pressure (IOP), considering the potential impact of tissue compression beneath the landing zone on aqueous outflow.[32,33] Recent research has assessed IOP changes before and after lens use. Measurements obtained after removal of SL showed minimal changes in IOP after short-term lens wear.[22,34] It has also been found that the IOP increased by 5 mmHg after 6 hours of SL wear.[35] Furthermore, the prolonged utilization of SL for the treatment of ocular diseases might change the biomechanical properties of the cornea.[36] After removing scleral lenses, it's important to consider changes in corneal thickness or shape, as these can impact IOP measurements.[37] Corneal edema was evaluated through the assessment of corneal transparency and thickness. Scholars have noted that short-term wear of SL can lead to an increase in central corneal edema, which correlates with the thickness of the central lens.[38] Central corneal edema caused by wearing SL is more serious in patients who have undergone penetrating keratoplasty, as evidenced by notable alterations in the anterior corneal topography and high-order aberrations following short-term SL wear, potentially attributable to corneal epithelial edema.[23,25] Over the past century, various strategies have been employed to address corneal edema induced by SL. These strategies include enhancing tear exchange and oxygen delivery through modifications such as adjusting the pH of the reservoir, periodically removing the lens or reducing the duration of lens wear, and incorporating window or channel openings into the lens design.[39]

SL can serve as stable platforms for various optical uses because they remain steady and move minimally during blinking. Some studies have shown that wavefront-guided SL can reduce higher-order aberrations improve visual quality and enhance visual acuity.[40,41] A reflecting telescope system incorporating an embedded SL has been created.[11,12] However, the integration of PMMA with a rigid, breathable material exceeding 1.6 mm in thickness leads to corneal hypoxia, necessitating further refinement.[42] This system holds potential applications in military contexts and low vision rehabilitation. Herbert De Smet et al conducted a study on an artificial iris integrated within SL.[43] This innovative smart contact lens features adjustable light transmittance, enabling it to function as an artificial iris for the regulation of incident light.

Inevitably, there are some limitations to this study. First, the database selected was the WOS Core Collection and Scopus database, excluding other databases, such as PubMed, Cochrane Library, and Google Scholar. While this study attempted to integrate synonymous terms during the analysis, there may be limitations to the extent of this integration. In addition, the focus on journal papers overlooks valuable insights from alternative knowledge sources, such as books, which could result in the omission of significant research findings. Therefore, future research is needed to enrich the data sources and anticipate emerging trends in the field of SL research. In contrast to Povedano-Montero's (2018) bibliometric analysis of SL,[44] this study utilized two databases, WOS and Scopus, to conduct a more comprehensive bibliometric analysis. By incorporating a broader range of literature and employing visual analyses, this study enhances the intuitiveness of the results. This study serves as an extension of Povedano-Montero's work, collectively offering a chronological progression of SL development from inception to the present, thereby providing valuable insights for guiding future clinical research.

Conclusion

This study provides a comprehensive bibliometric analysis of the SL research field and focuses on the development of SL over the past decade. SL research has garnered significant interest within the academic community. Through keyword co-occurrence and clustering, the research direction and trends in SL have been elucidated. Research on SL is centered on elucidating the physiological impacts of SL wear and related complications, including corneal edema and midday fogging. The objective is to furnish clinicians with valuable insights to optimize lens wear and enhance patient outcomes, ultimately aiming to improve the safety and efficacy of SL utilization. SL has emerged as a prominent area of investigation in the field of ophthalmology. Global differences in SL research outcomes largely stem from varying regional research focuses and priorities. Resource and funding availability significantly affect research quality and quantity, with countries having robust research institutions and funding agencies likely producing more comprehensive and clinically relevant studies. Many studies use small samples and retrospective designs, limiting their generalizability. To address this, SL research needs more rigorous, standardized methods. Prospective, multicenter trials with larger samples and uniform outcomes would offer stronger evidence for clinical practice. Increased collaboration among researchers worldwide could also harmonize efforts and tackle global disparities in this field. It is expected that this research will help scholars understand the prevalent trends in the field, promote academic discussions and collaborations, and ultimately enhance their global impact within this field.

Data Sharing Statement

Data are available on request.

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Disclosure

The authors report no conflicts of interest in this work.

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