

The Evolution of Tzanck Smear Publications: A Bibliometric Analysis with Research Trends and Global Productivity

Esra Altay, Selami Aykut Temiz, İlkay Özer, Munise Daye, Recep Dursun

Department of Dermatology and Venereology, Necmettin Erbakan University Faculty of Medicine, Konya, Türkiye

Abstract

Aim: Tzanck smear is a diagnostic tool where the structural characteristics of cells are examined under microscope after undergoing various staining procedures. It is a cost-effective and reliable application that aids clinicians in the diagnostic process in many fields, particularly dermatology. Bibliometric analysis is a methodology that visualizes study topics, authors, countries, and trends in a scientific field, accompanied by numerical data. This study presents a bibliometric analysis of the Tzanck smear literature.

Materials and Methods: Web of Science database was used for literature search; VOSviewer and Biblioshiny software were preferred for bibliometric analysis.

Results: According to the bibliometric data obtained, herpes and pemphigus group diseases have been the central focus of Tzanck smear studies. Recently, while these two topics have maintained their trend, there has been an increase in Tzanck smear publications related to the Monkeypox virus. The leading authors in terms of publication count are Durdu M, Seckin D, and Folkers E, while the most cited authors are Durdu M, Leonardi CL, and Nahass GT. The leading countries in publishing studies on Tzanck smear are the United States, India, and Türkiye. Journals receiving the most publications and citations on Tzanck smear include the Journal of the American Academy of Dermatology, International Journal of Dermatology, Indian Journal of Dermatology, Venereology and Leprosy, Journal of the American Medical Association, and Archives of Dermatology.

Conclusion: In this study, an attempt was made to create quantitative maps of studies conducted on the topic of Tzanck smear. This study fills an important gap in the literature by representing the first comprehensive bibliometric analysis specifically focused on the topic of Tzanck smear. A review of the literature shows that researchers, countries, and journals have demonstrated varying trends regarding Tzanck smear over the years. The statistical evaluation of these trends through bibliometric analysis can provide a roadmap for researchers planning to work on this topic when designing their studies.

Keywords: Tzanck smear, cytodiagnosis, bibliometric, herpes simplex, pemphigus, skin neoplasms

INTRODUCTION

Cytology is a method based on the examination of the characteristic morphological features of cells. It is a diagnostic tool beneficial for the early diagnosis and treatment of various diseases.¹ Although its first use dates back to the mid-19th century, its application in dermatology was initiated by Arnault Tzanck in 1947, and subsequently, its uses in the field of dermatology began to be referred to as the “Tzanck smear test.”² The Tzanck smear test offers numerous advantages, being simple, rapid, reliable, inexpensive, repeatable, without requiring anesthesia, and

painless. Therefore, it is one of the ideal diagnostic methods clinicians can resort to in the process for appropriate patients.³ Bibliometric analysis is an analytical method used to obtain formal and quantitative data on the current state of a field, facilitating the tracking of academic trends through visualization. Through these analyses, quantitative findings are obtained regarding country, author, university, and journal productivities related to the specified topic, weak and strong sub-research areas, collaboration networks, literature gaps, and potential opportunities for future research.^{4,5}

Address for correspondence: Esra Altay, MD,

Department of Dermatology and Venereology, Necmettin Erbakan University
Faculty of Medicine, Konya, Türkiye
Email: dermatologistesra@gmail.com
ORCID ID: 0009-0008-0418-8625

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This study aimed to summarize the Tzanck smear literature between 1983 and 2024 using bibliometric analyses. The study thereby examines the trends, author and country tendencies, prominent or overlooked aspects, and scrutinizes the literature in this field.

MATERIALS AND METHODS

In this study, the Web of Science database was used for literature search, and VOSviewer, and Biblioshiny software were preferred for bibliometric analysis. On March 14, 2025, a search was conducted in Web of Science using the keyword “Tzanck smear” with “all fields” selected. A total of 182 publications were retrieved, with the oldest from 1983 and the newest from 2024. The retrieved data were analyzed through author-citation-journal-country, and keyword analyses. The threshold values and filtering criteria used in the analyses were determined as follows: author co-authorship analysis: minimum (min.) 2 publications and at least 1 citation; citation analysis: min. 2 publications and at least 1 citation; citation analysis: min. 2 publications and at least 1 citation; citation analysis: journals with at least 1 citation; co-citation analysis: min. 5 citations.

The clustering analysis used the LinLog/modularity-based algorithm of VOSviewer software, which is the VOSviewer default. It creates clusters based on the density of connections between nodes (e.g., authors, countries, or keywords). Analyses were visualized through network maps where node size represents volume (e.g., publications or citations) and color indicates clustering. Temporal trends were visualized using color gradients from purple (older) to yellow (newer).

RESULTS

The study included 134 journal articles, 25 editorial materials, 9 book chapters, 7 review articles, and 7 meeting abstracts. In terms of disciplines, the vast majority of studies belonged to dermatology (107), followed by internal medicine (19), pathology (19), medical laboratory technology (13), infectious diseases (11), experimental medicine and research (7), immunology (7), pediatrics (6), microbiology (6), and surgery (6).

Most Productive Authors in the Field of Tzanck Smear

In the analysis conducted on the Web of Science database using the keyword “Tzanck smear” with “all fields” selected, the top 3 most productive authors, ranked by publication count, were identified as Durdu M. (30 publications), Seckin D. (7 publications), and Folkers E. (6 publications). The 10 most productive authors are shown in Figure 1.

Most Productive Countries in the Field of Tzanck Smear

In the analysis conducted on the Web of Science database using the keyword “Tzanck smear” with “all fields” selected, and based on the country of origin of the publications (determined by the corresponding author), the top 3 most productive countries were identified as the United States of America (USA), India, and Türkiye. The productivity of countries is depicted in Figure 2.1 and Figure 2.2, while the total number of publications in the Tzanck smear literature by year is shown in Figure 2.3.

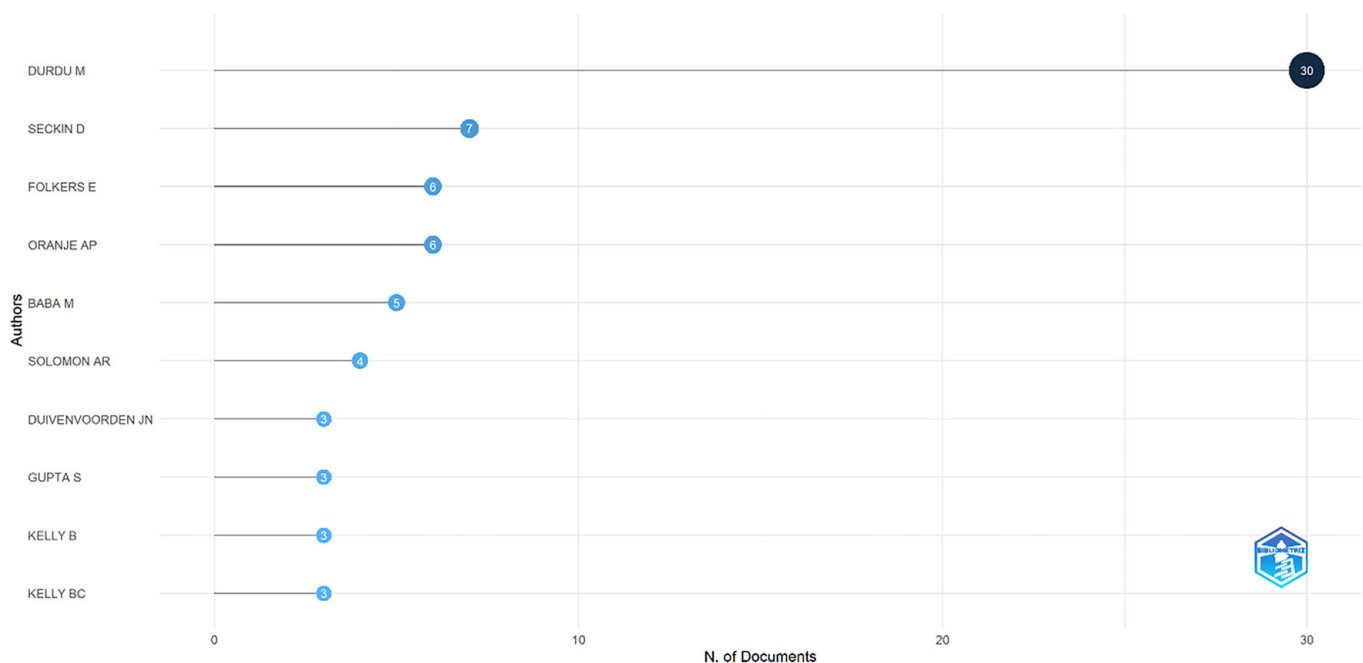


Figure 1. The 10 most productive authors in the Field of Tzanck smear

Co-authorship Analysis

According to the co-authorship analysis, a network map was created using a min. criterion of 2 publications and at least 1 citation to identify authors with the most connections and collaborations. The analysis of authors with the most connections revealed 46 authors grouped into 17 distinct clusters, with a total of 55 links. When examined by year, it is noteworthy that Folkers et al.⁷ engaged in co-authorship in the early publications within the Tzanck smear literature⁶, while Noormohammadpour et al.⁸ have co-authored more recent publications (Figure 3).

Author Citation Analysis

To identify citation networks, a network map for author citation analysis was generated using the criteria of a min. of two publications and at least one citation. The analysis, conducted on 397 interconnected authors, identified 12 clusters, 5386 links, and a total link strength of 10455. The most cited authors were Durdu M. with 259 citations, Leonardi CL with 152 citations, and Nahass GT with 152 citations. According to total link strength, the top 3 authors were Durdu, M., Baba, M., and Seckin M. (Figures 4.1 and 4.2).

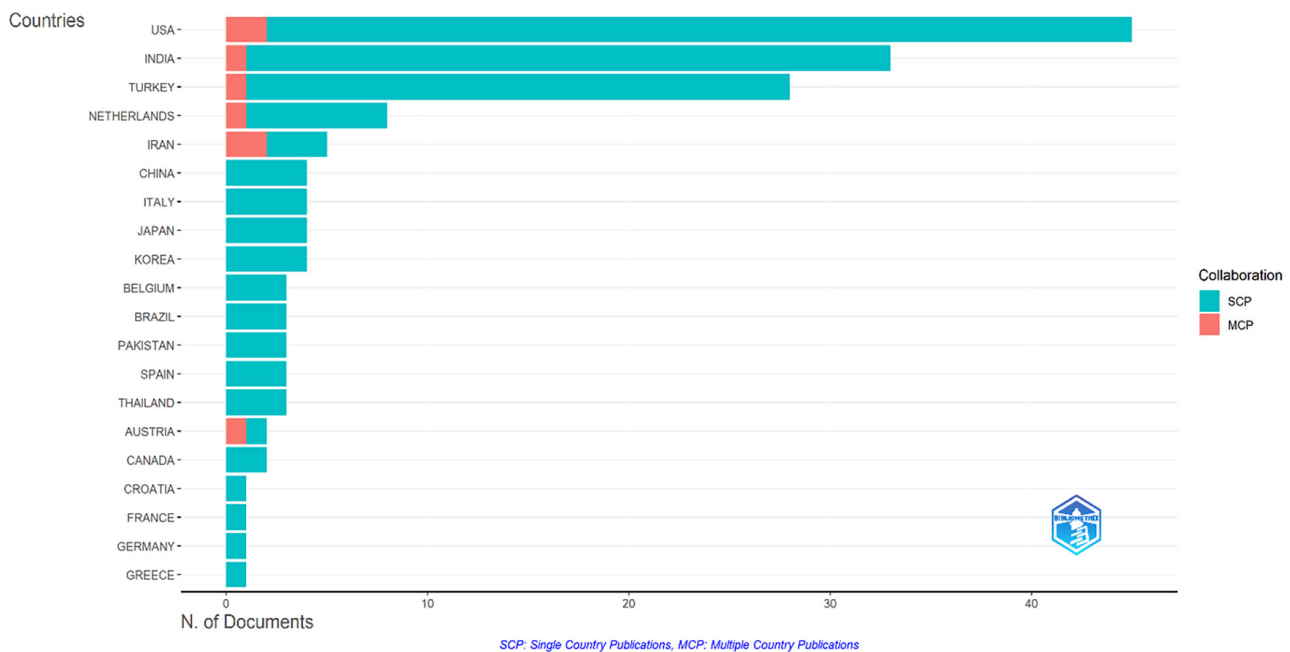


Figure 2.1. Most productive countries in the field of Tzanck smear

USA: United States of America, SCP: Secure copy protocol, MCP: Microsoft certified professional

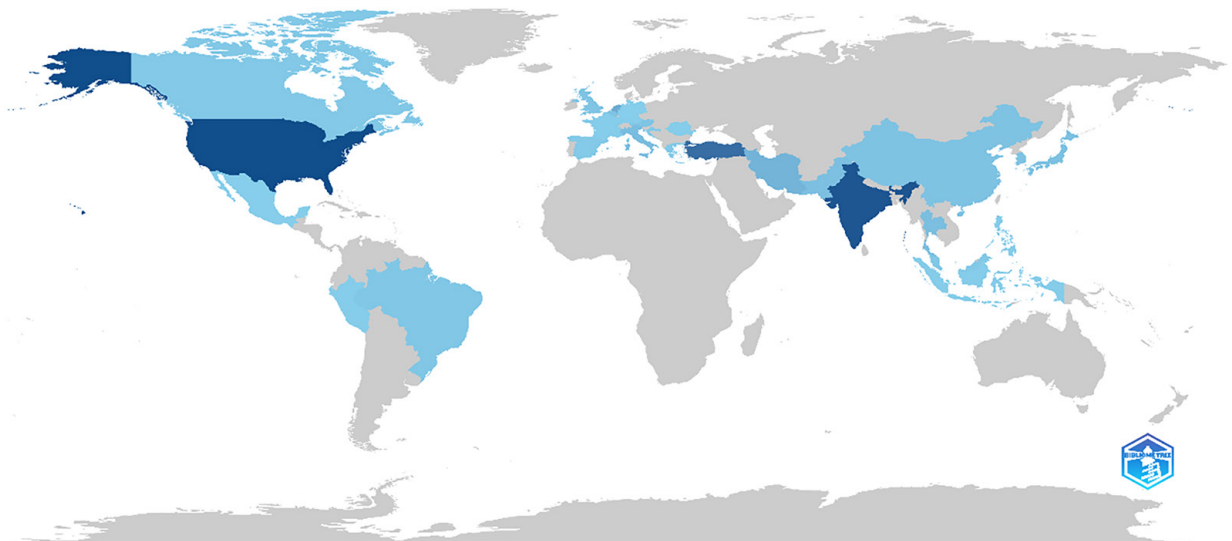


Figure 2.2. Most productive countries in the field of Tzanck smear (map visualization)

Country Citation Analysis

A network map of the citations received by publications according to their source countries was created. The analysis was conducted on 14 interconnected countries, with the requirement that a country must have published at least 2 works and received at least 1 citation. This identified 5 clusters, 32 links, and a total link strength of 177. The most cited countries were the USA (795 citations), Türkiye (270 citations), and India (196 citations). In terms of total link

strength, the USA and Türkiye were followed by Italy. The ranking by total number of published works was the USA (47 publications), India (34 publications), and Türkiye (30 publications) (Figures 5.1 and 5.2).

Publication Citation Analysis

To create a network map of citations received by publications, an analysis was conducted on 100 interconnected publications, each having received at least 1 citation. This identified 15

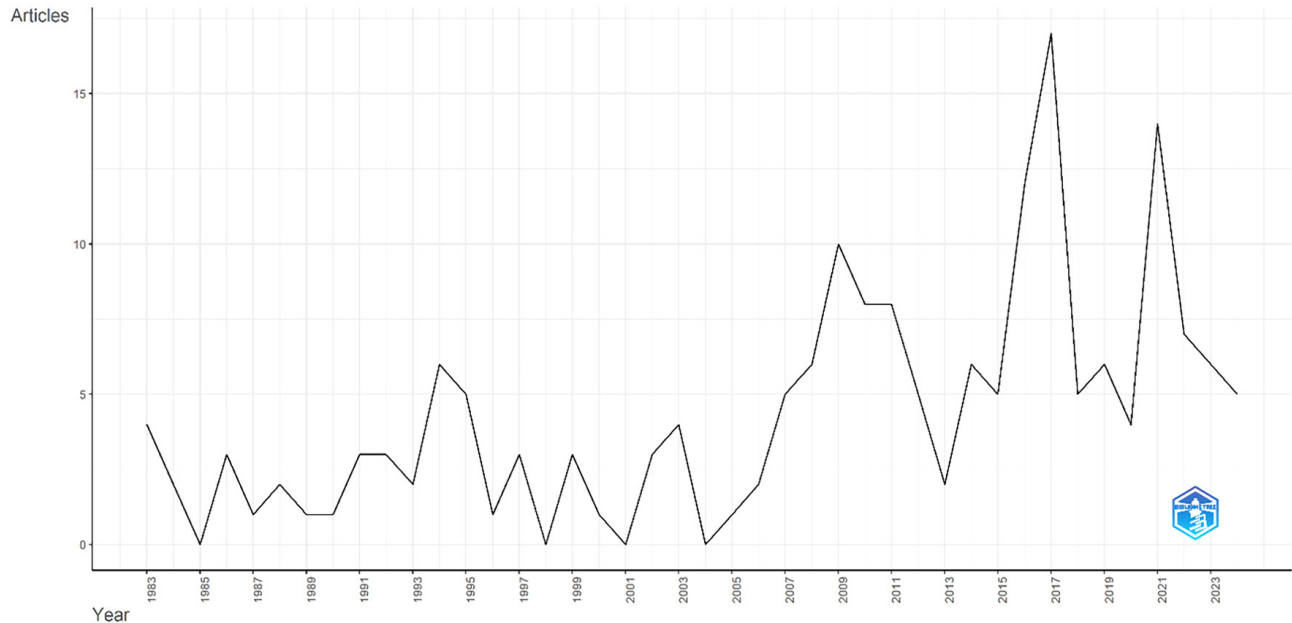


Figure 2.3. A line chart representing the yearly publication trends. Peaks observed in 2009, 2017, and 2022 reflect surges in academic interest, possibly linked to clinical or diagnostic developments

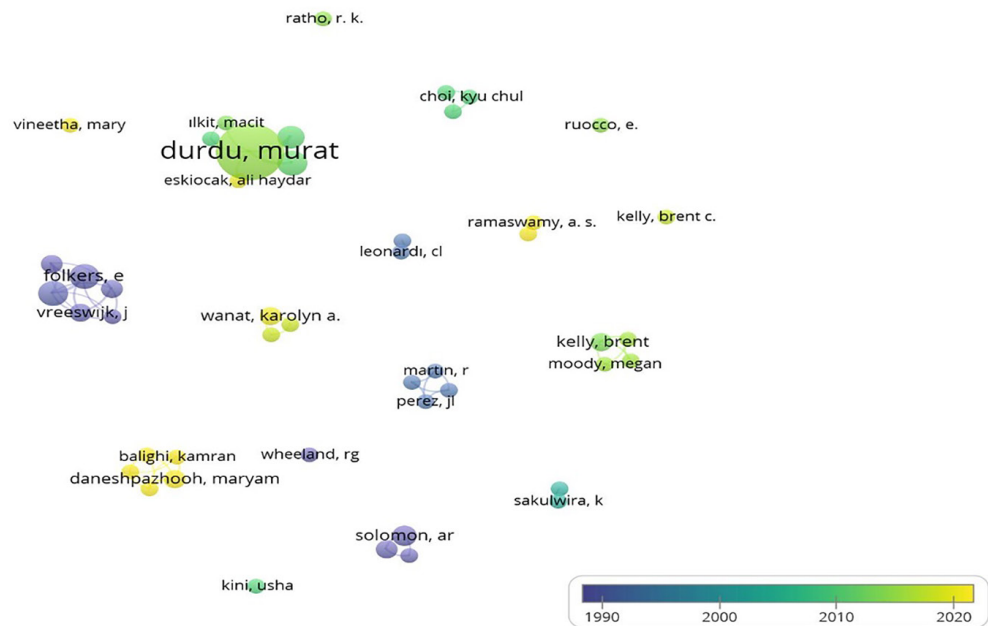


Figure 3. Network visualization showing co-authorship links among authors who have published at least two articles and received at least one citation. Each cluster indicates a group of closely collaborating researchers. Color gradients from purple to yellow represent temporal evolution, with yellow being more recent

clusters and 291 links. The top 3 most cited publications were Nahass et al.⁹ (215 citations), Durdu et al.¹⁰ (167 citations) and Solomon et al.¹¹ (153 citations). In terms of total link strength, the top 3 publications were Durdu et al.¹⁰, Eryilmaz et al.¹² and Solomon et al.¹³ (Figure 6).

Source (Journal) Citation Analysis

To create a network map for source (journal) citation analysis, an analysis was conducted on 20 interconnected journals that had published articles on Tzanck smear, with a criterion of at least 1 citation received by articles within them. The analysis identified 7 clusters and 47 links. The top 3 journals publishing the most articles on Tzanck smear were the Journal of the American Academy of Dermatology (22 publications), International Journal of Dermatology (11 publications), and Indian Journal of Dermatology, Venereology and Leprosy (7 publications). When compared by citation counts, the journals receiving the most citations for articles on this topic were the Journal of the American

Academy of Dermatology (307 citations), Journal of the American Medical Association (JAMA) (199 citations), and Archives of Dermatology (159 citations). According to the link strength analysis, calculated based on the co-citation of sources (journals) within the same article, the three strongest journals were the Journal of the American Academy of Dermatology, International Journal of Dermatology, and JAMA (Figure 7).

Keyword Analysis

In the analysis of keywords used by authors, a total of 227 keywords were identified, forming 689 links within 30 clusters. The most frequently used keywords in publications related to Tzanck smear were “Tzanck smear” (28 occurrences), “cytology” (18 occurrences), “pemphigus” (10 occurrences), and “acyclovir” and “herpes zoster” (6 occurrences each). In terms of total link strength, these terms also ranked highest in the same order (Figures 8.1, 8.2 and 9).

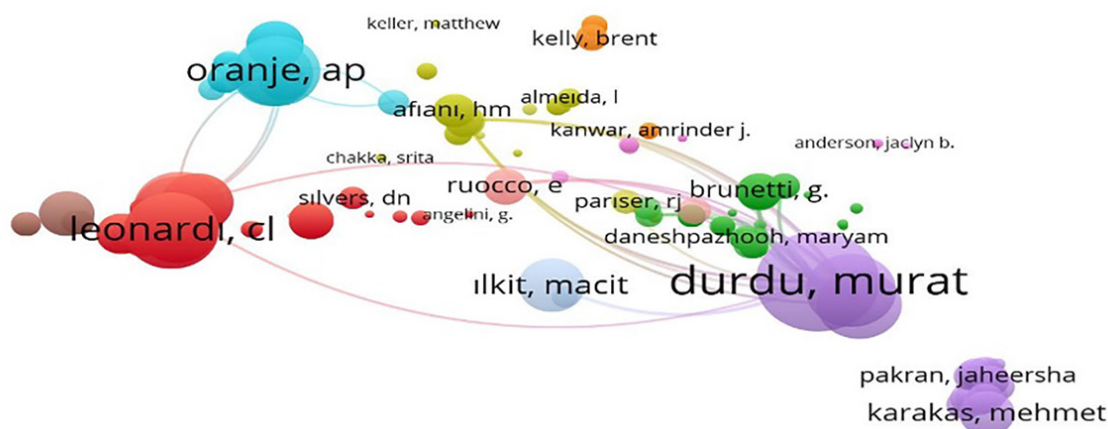


Figure 4.1. This figure shows citation relationships among the most cited authors in the Tzanck smear literature. Node size corresponds to citation volume, and link strength reflects shared citation patterns, helping identify key influencers in the field

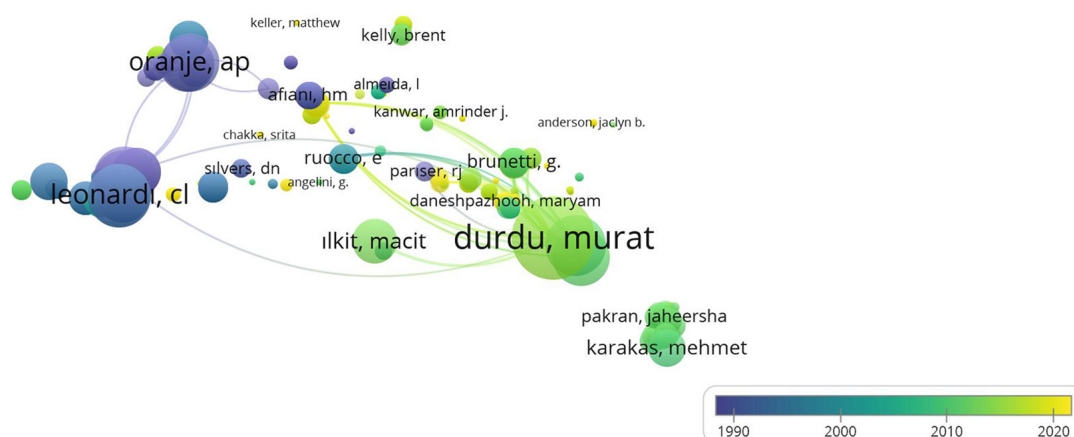


Figure 4.2. Same as Figure 5.1 but color-coded based on the year of most cited work. This allows assessment of which influential authors emerged early or more recently

Author Bibliographic Coupling Analysis

Bibliographic coupling occurs when two independent sources cite a common work/author.¹⁴ For the bibliographic coupling analysis, a criterion of having published at least 2 works and having received at least 1 citation was selected. The analysis, conducted on 46 interconnected authors, yielded 7 clusters, 525 links, and a total link strength of 8392. Authors with the highest bibliographic coupling (measured by total link strength) were Durdu M (2540 total link strength; 259 total citations), Leonardi CL (166 total link strength; 152 total citations), and Nahass GT (166 total link strength; 152 total citations) (Figure 10).

Author Co-Citation Analysis

Co-citation is the frequency with which two documents are cited together by other documents.¹⁵ With a min. co-citation count of 5, the analysis conducted on 50 authors identified a total of 6 clusters, 556 links, and a total link strength of 2441. The most co-cited authors were Durdu M (98 co-citations), Solomon AR (63 co-citations), and Ruocco V (48 co-citations) (Figure 11).

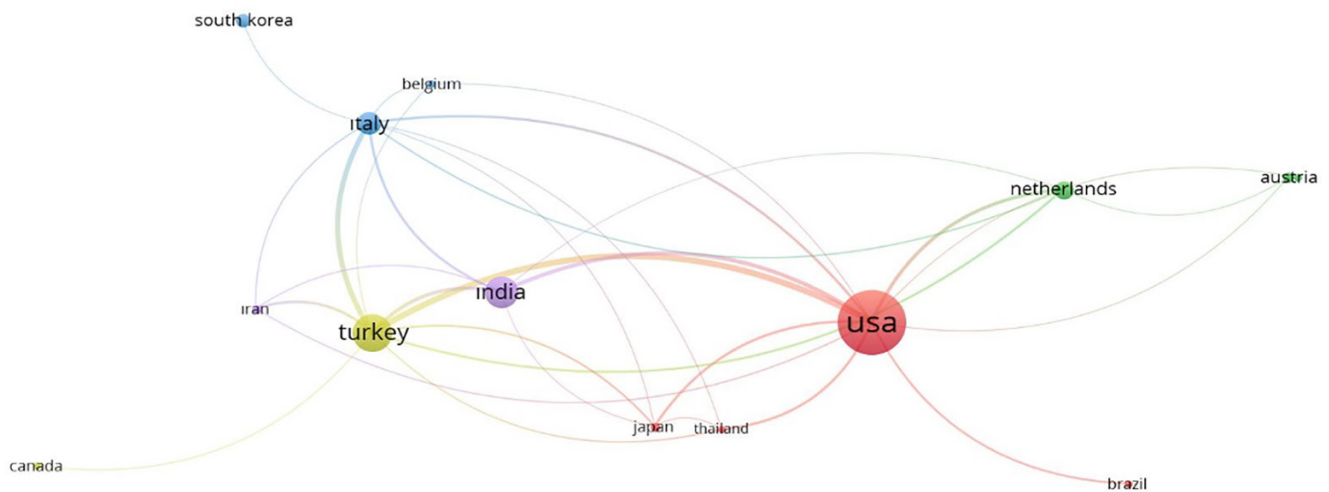


Figure 5.1. Displays how countries cite each other's work in the Tzanck smear literature. Node size reflects citation count received, links indicate citation connections. The USA, Türkiye, India appear as central players
USA: United States of America

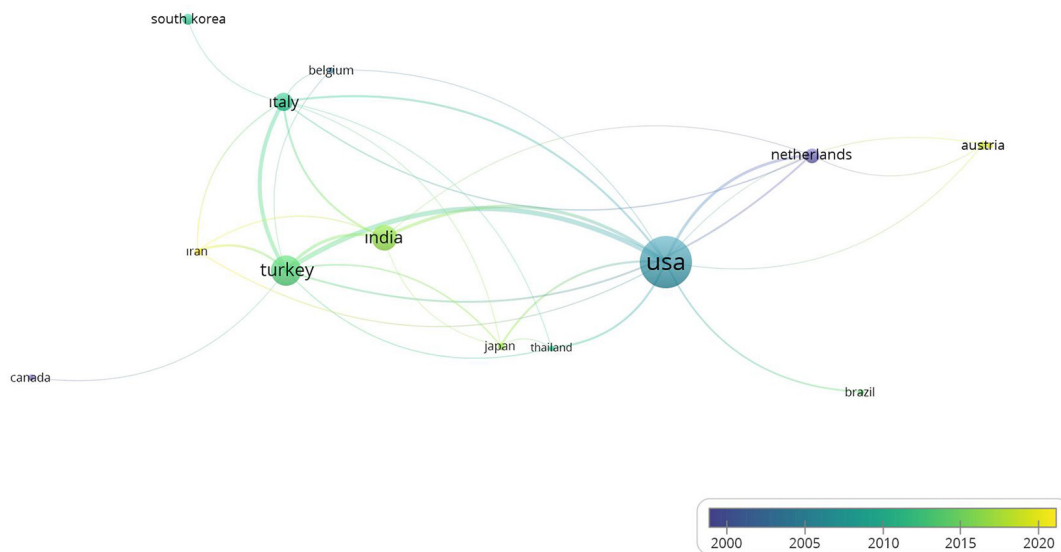


Figure 5.2. Color gradient indicates the chronological distribution of country citations. It helps understand which countries contributed earlier and which became active more recently
USA: United States of America

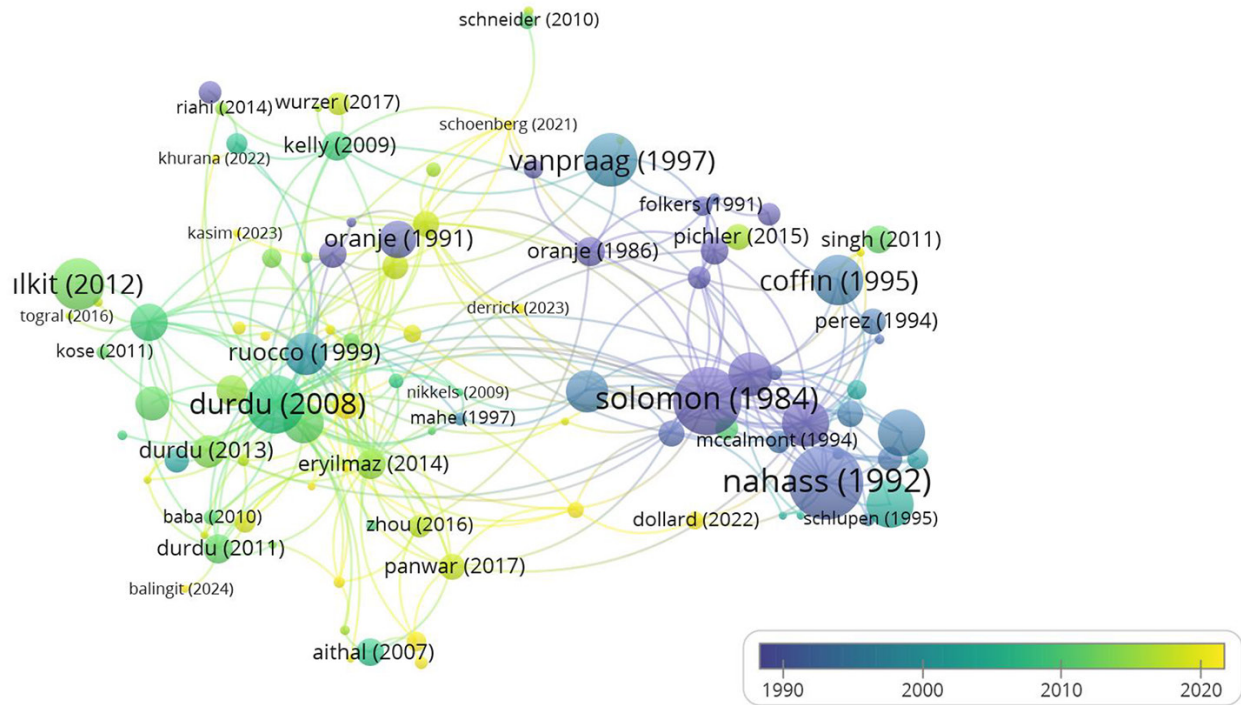


Figure 6. Network visualization of 100 publications with at least one citation. Larger nodes indicate more frequently cited studies. Clusters highlight thematic or topical groupings

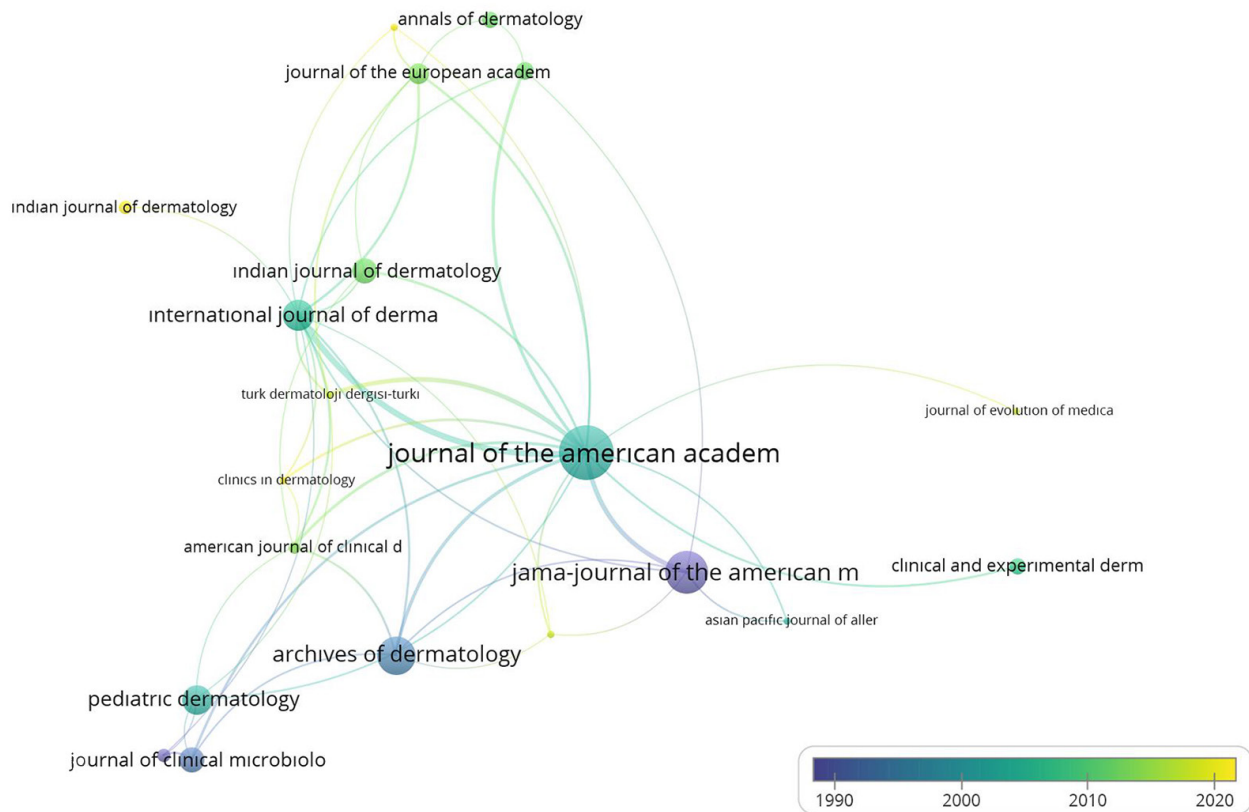


Figure 7. This figure maps inter-journal citation relationships based on co-citation frequency. Journals like Journal of the American Academy of Dermatology (JAMA), and International Journal of Dermatology appear as central nodes

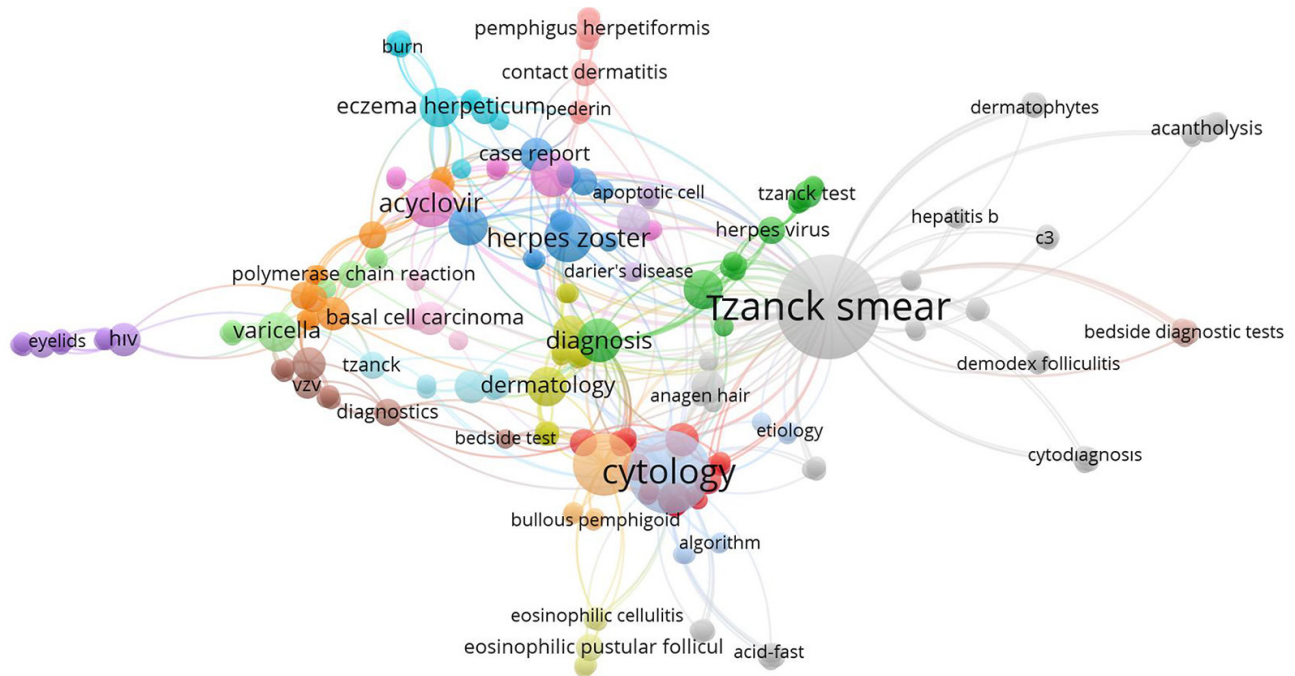


Figure 8.1. Shows how keywords are used together in the same publications. The size of each keyword reflects frequency, while link strength reflects co-occurrence. “Tzanck smear”, “cytology”, and “pemphigus” form central clusters

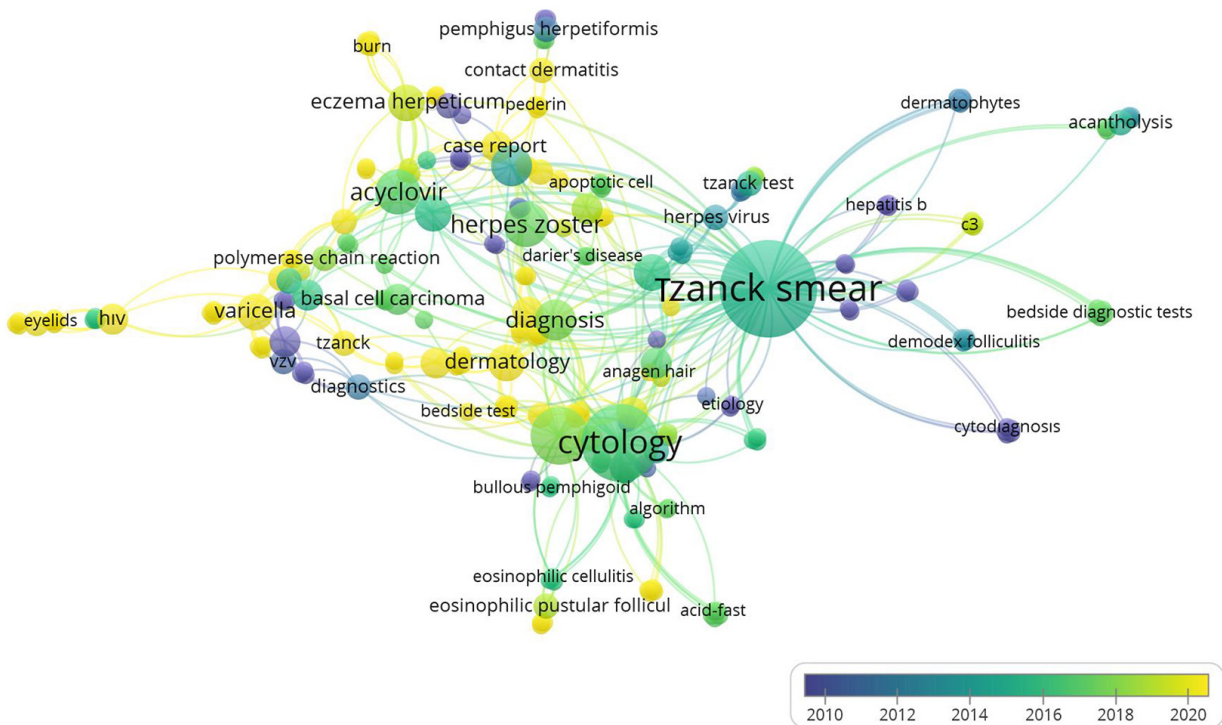


Figure 8.2. Similar to Figure 9 but color-coded by average publication year, helping identify shifts in topic focus over time

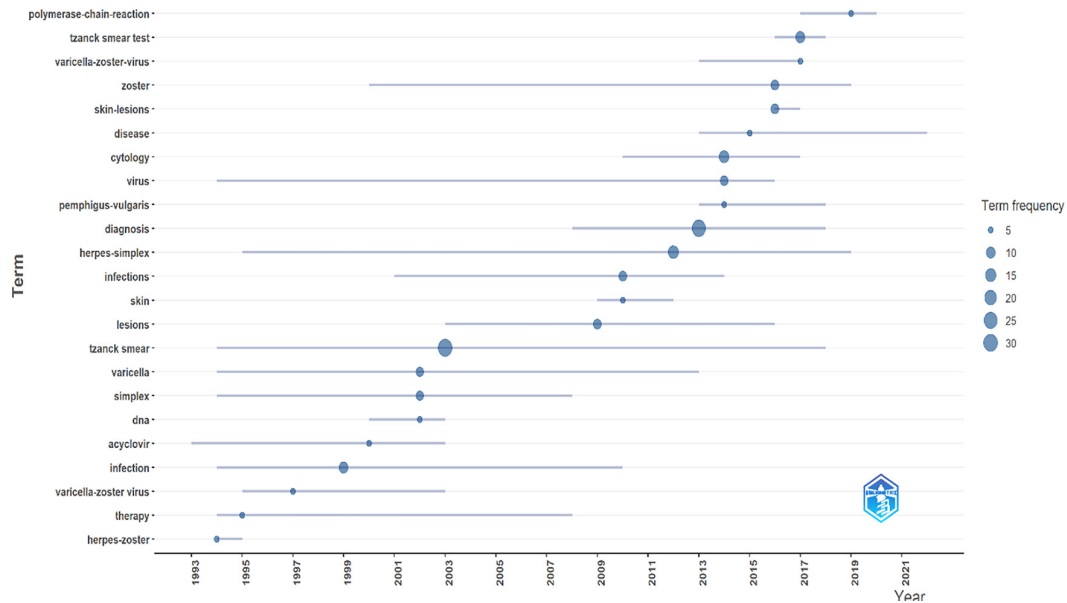


Figure 9. Line graph showing the changing usage rates of top keywords over the years. Helps visualize rising or declining interest in subtopics such as “acyclovir”, “herpes zoster”, and “skin tumors”

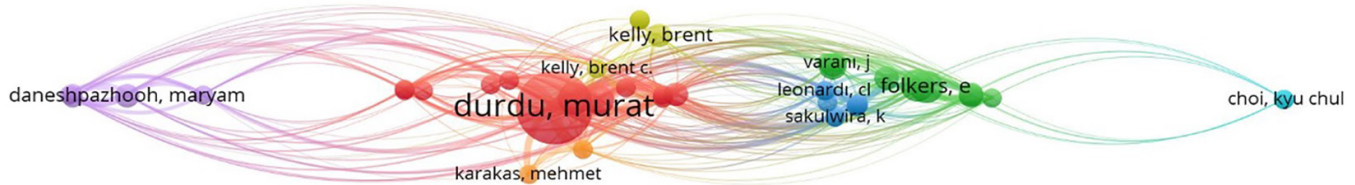


Figure 10. Visual representation of authors who cite the same references. Strong coupling indicates thematic or methodological similarity. Durdu M. again emerges as a central person with the highest coupling strength

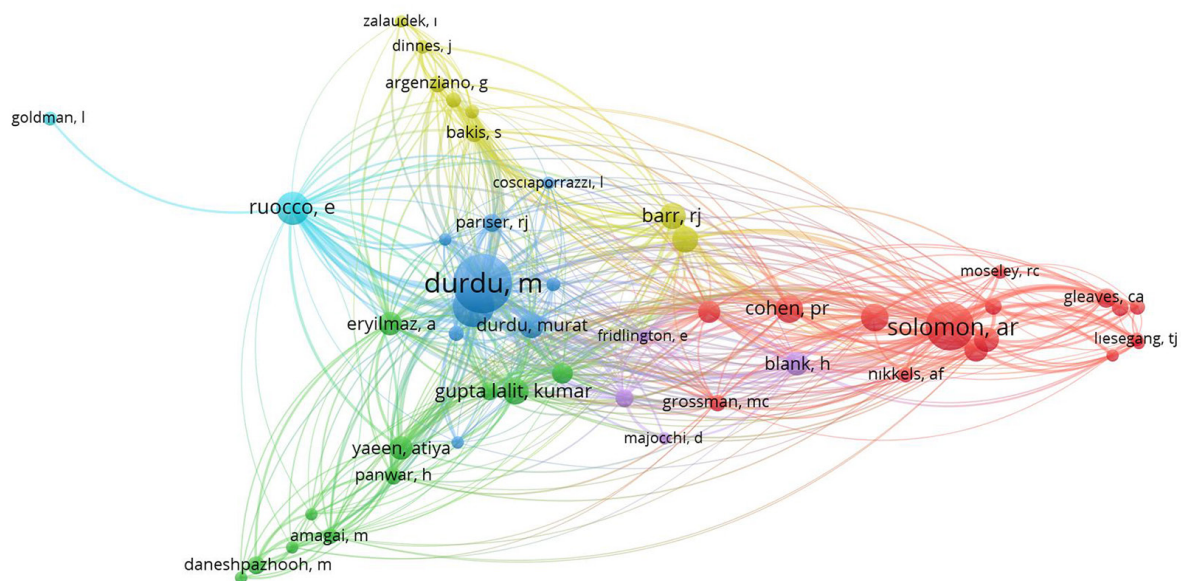


Figure 11. Authors that are frequently cited together by other articles form this network. Clusters reflect groups of authors perceived as conceptually linked. High co-citation implies foundational or frequently referenced work

DISCUSSION

Bibliometrics is a scientific field that provides statistical analysis of academic literature, defining publication and citation trends in a specific area.⁴ In this study, an attempt was made to create quantitative maps of studies conducted on the topic of Tzanck smear. This analysis provides a comprehensive overview of the Tzanck smear topic between 1983 and 2023, offering significant insights into global trends, productive authors and countries, leading journals, and influential publications.

The Tzanck smear has been studied in dermatology for various conditions, including vesiculobullous diseases (e.g., pemphigus group diseases, Stevens-Johnson syndrome/toxic epidermal necrolysis, staphylococcal scalded skin syndrome), infectious diseases (e.g., impetigo, fungal infections primarily dermatophytes; and candidal infections, herpes group diseases, viral diseases like molluscum contagiosum, cutaneous leishmaniasis), genodermatoses (e.g., Hailey-Hailey disease, Darier disease), and cutaneous tumors (e.g., basal cell carcinoma, squamous cell carcinoma, Paget's disease, Langerhans cell histiocytosis).¹⁶ The herpes virus group and pemphigus have long been central topics in Tzanck smear research and continue to be prominent today. In recent years, there has been a notable rise in publications related to the Monkeypox virus.^{17,18} A review of recent literature suggests that the Tzanck smear is gaining broader application in specific areas of dermatology, particularly in cutaneous malignancies and granulomatous diseases, and its use is expected to increase in these fields.

According to bibliometric data, the leading authors by publication count are Durdu M, Seckin D, and Folkers E, while the leading authors by citation count are Durdu M, Leonardi CL, and Nahass GT. Identifying prominent authors by publication and citation count can help researchers prioritize relevant publications during literature reviews.

The leading countries publishing on Tzanck smear are the USA, India, and Türkiye. Encouraging more contributions from countries currently underrepresented in this field could enhance both the literature and the global understanding of the topic. Collaboration analyses between countries and authors highlight the importance of multicenter studies for comprehensive global assessments.

Co-authorship analysis reveals that several authors have consistently collaborated over time. Among them, Folkers E and Durdu M (each with a total link strength of 16), and Oranje AP (link strength of 13) stand out as key figures in collaborative networks.

Türkiye's prominent role in authorship and citation metrics suggests a strong research base that can be leveraged for future multicenter collaborations. These insights can guide researchers in selecting relevant topics, target journals, and potential collaborators. In this study, Türkiye ranked third globally in the number of publications on Tzanck smear, following the USA and India. Among the top 10 most productive authors, multiple contributors are affiliated with Turkish institutions, including Durdu M, who is the most prolific and most cited author. This demonstrates that Türkiye has become a central node in Tzanck smear research, especially in terms of clinical application and academic output. Increasing inter-institutional collaboration within Türkiye and promoting multicenter bibliometric studies could further enhance this contribution.

According to the annual distribution of publications on Tzanck smear, the first publications on this topic appeared in 1983, and contributions have been consistently made to the literature almost every year since then, albeit with fluctuations, up to 2024. The three peaks, particularly in 2009, 2017, and 2022, indicate a greater inclination towards publishing on the subject and a higher number of publications in those years.

Looking at the journals where Tzanck smear topics are most frequently published and cited, these include the Journal of the American Academy of Dermatology, International Journal of Dermatology, Indian Journal of Dermatology, Venereology and Leprosy, JAMA, and Archives of Dermatology. From this, it appears that studies on Tzanck smears attract the attention of prestigious journals. Furthermore, identifying these articles will assist researchers both in pre-publication literature searches and in selecting suitable journals for their manuscripts. Among the most frequently used keywords in Tzanck smear publications are "Tzanck smear", "cytology", "pemphigus", "acyclovir", and "herpes zoster". Link strength analysis indicates that these terms are often used together in the same articles. Topics related to herpes and varicella viruses have remained consistently prominent over the years, whereas monkeypox-related keywords have emerged more recently. Keywords play a critical role in summarizing a study's content and enhancing its visibility in databases. Therefore, selecting keywords that are MeSH-compliant, relevant, up-to-date, and semantically linked is essential during the study design phase.

Study Limitations

One of the significant limitations of the study is that the analyses were confined to publications indexed in the Web of Science Core Collection, excluding research from other databases such as Scopus, PubMed, and Google Scholar. Therefore, some important studies, particularly those with limited international visibility, may have been overlooked.

To make a comparison between these databases via PubMed, we observed that the overall trends compared with the PubMed database were parallel to those found in Web of Science. However, because the software used in the data analysis process (VOSviewer, Biblioshiny) did not integrate with PubMed data, the visualizations were based solely on Web of Science data.

Another limitation is the reliance on citation counts as a measure of impact. While citations provide a useful insight into a publication's impact, they may not fully reflect the quality or significance of the research. Some highly cited studies may be outdated or criticized for methodological flaws, yet continue to receive citations. Conversely, newer studies may not have accumulated enough citations to be recognized in bibliometric analyses. Therefore, more comprehensive studies on this topic are needed.

CONCLUSION

This study fills an important gap in the literature by representing the first comprehensive bibliometric analysis specifically focused on the topic of Tzanck smear. In the literature, researchers, countries, and journals have shown varying trends regarding Tzanck smear over the years. Türkiye's prominent role in authorship and citation metrics suggests a strong research base that can be leveraged for future multicenter collaborations. The statistical evaluation of these trends bibliometrically can provide a roadmap for researchers planning to work on this topic when designing their studies.

Ethics

Ethics Committee Approval: Not applicable.

Informed Consent: Not applicable.

Footnotes

Authorship Contributions

Concept: E.A., S.A.T., İ.Ö., M.D., R.D., Design: E.A., S.A.T., İ.Ö., M.D., R.D., Data Collection or Processing: E.A., Analysis or Interpretation: E.A., S.A.T., İ.Ö., M.D., R.D., Literature Search: E.A., Writing: E.A., S.A.T.

Conflict of Interest: The authors declared that they have no conflict of interest.

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