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Scientific Mapping of the Laminate Veneers in Dentistry: Bibliometric Analysis-Methodological Studies

Diş Hekimliğinde Laminate Veneerlerin Bilimsel Haritalanması: Bibliyometrik Analiz-Metodolojik Çalışmalar

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ABSTRACT Objective: Laminate veneer (LV) restorations are widely studied in dental research; however, a thorough bibliometric analysis is still lacking on this topic. **Material and Methods:** The literature search was based on the Web of Science database, focusing on papers related to LVs published between 2014-2023. The data recorded includes title, abstract, keyword, author, publication time, institution, and reference. Bibliometric networks were visualized using VOSviewer. This bibliometric analysis offers a comprehensive overview of LV research, countries, institutions, authors, journals, and article keywords between 2014-2023. **Results:** The bibliometric analysis included 457 publications. Brazil emerged as the country with the highest publication output. Özcan was the most productive author, while Universidade Estadual Paulista led in institutional publication count. The Journal of Esthetic and Restorative Dentistry had the largest number of publications, whereas the Journal of Prosthetic Dentistry received the highest number of citations. VOSviewer keyword analysis showed the most important research interests, such as dental veneers, ceramics, and computer aided design-computer aided manufacturing (CAD-CAM). **Conclusion:** According to recent publications, studies on the success of CAD-CAM blocks in LVs, the effect of enamel thickness and debonding techniques have become popular. It is thought that studies of LV will continue in dentistry.

Keywords: Bibliometrics; computer-aided design; dental prosthesis; dental veneers

ÖZET Amaç: Laminate veneer (LV) restorasyonları, diş hekimliği araştırmalarında yaygın olarak incelenmektedir; ancak bu konuda kapsamlı bir bibliyometrik analiz hâlâ eksiktir. **Gereç ve Yöntemler:** Literatür taraması, 2014-2023 yılları arasında yayınlanmış LV ile ilgili makalelere odaklanan Web of Science veritabanına dayanmaktadır. Kaydedilen veriler başlık, özet, anahtar kelime, yazar, yayın zamanı, kurum ve referansları içermektedir. Bibliyometrik ağlar VOSviewer kullanılarak görselleştirilmiştir. Bu bibliyometrik analiz, 2014-2023 yılları arasında LV araştırmaları, ülkeler, kurumlar, yazarlar, dergiler ve makale anahtar kelimeleri hakkında kapsamlı bir genel bakış sunmaktadır. **Bulgular:** Bibliyometrik analiz, 457 yayını içermektedir. En yüksek yayın çıktısına sahip ülke Brezilya olarak ortaya çıkmıştır. En üretken yazar Özcan iken, kurumsal yayın sayısında Universidade Estadual Paulista başı çekmektedir. The "Journal of Esthetic and Restorative Dentistry" en fazla yayına sahipken, the "Journal of Prosthetic Dentistry" en fazla atıf alan dergi oldu. VOSviewer anahtar kelime analizi, en önemli araştırma ilgi alanlarını veneer restorasyonlar, seramikler ve bilgisayar destekli tasarım-bilgisayar destekli imalat [computer aided design-computer aided manufacturing (CAD-CAM)] gibi konuları gösterdi. **Sonuç:** Son yayınlara göre LV'ler, CAD-CAM bloklarının başarısı, mine kalınlığının etkisi ve debonding teknikleri üzerine yapılan çalışmalar popüler hâle gelmiştir. LV çalışmalarının diş hekimliğinde devam edeceği düşünülmektedir.

Anahtar Kelimeler: Bibliyometri; bilgisayar destekli tasarım; diş protezi; dental veneerler

Since their introduction in the early 1980s, laminate veneers (LV) have become a popular option for the conservative treatment of various aesthetic and functional dental conditions.[1] LV restorations provide a minimally invasive alternative to traditional treatments, ideal for closing small diastemas, reshaping irregular teeth, and enhancing the color of discolored teeth.[2] While LVs are becoming more popular in aes-

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thetic dentistry, research continues to focus on this area to increase clinical success. Previous studies have frequently on LV restorations have evaluated parameters such as preparation design, material thickness, material type, type of resin cement used of its impact on success, surface roughness and color stability were evaluated.[2-6] In addition, with the development of technology, the computer aided design-computer aided manufacturing (CAD-CAM) production technique has frequently been examined in studies. However, the lack of a comprehensive bibliometric analysis study that reveals the general status of scientific studies in the field of LVs, collaboration networks among authors, research trends, and guide authors for future studies is striking.

The first step of a new study is the literature review. Literature review is important in academic research because it evaluates the general status of a research field and highlights areas that deserve further research. However, it has become increasingly complex.[7] Bibliometric analysis studies offer a systematic approach, guiding authors in reviewing and interpreting existing literature to gain insights into the development and influence of research within a specific field.[8,9]

This bibliometric study aimed to identify productive authors, affiliations, countries and journals on the subject of LV, as well as to map the networks and geographical distribution of global research in the field. It also provided a quantitative assessment of research productivity, impact and current developing trends. It is believed that the results obtained will guide future studies in the field of LV restorations and will be a comprehensive source of information for researchers.

MATERIAL AND METHODS

Ethical approval is not required for bibliometric research, as it does not involve human or animal participants.

In November 2024, a search was made in the WoS database according to the keyword “Laminate veneer”. The search was confined to the topic field, encompassing titles, abstracts, author keywords, and the time limited 2014-2023.

A total of 2,087 documents were retrieved and then filtered to include only “Article” and “Review Article” publication types, limited to the English language, and the topic of Dentistry&Oral Medicine. Science Citation Index Expanded, Conference Proceedings Citation Index-Science, Book Citation Index-Science, and Emerging Sources Citation Index indexes were searched. A total of 457 documents were included in this study, Figure 1 shows the flowchart of literature inclusion. The saved process was completed in a single day to prevent fluctuations in citation information caused by the rapid updating of publications. Two independent researchers (N.Ş. and Ç.U.) manually performed data saving to minimize bias.

The export types selected were “Research Information Systems” and “Plain Text File”, and the record content selected was “Full Record and Cited References”.

The literature’s authors, institutions, affiliation, countries, publication title, overall time distribution, WoS index, citation information and the H-index from the Web of Science (WoS) analysis result and WoS citation report. Country, authors, co-authorship analyses and keyword maps were performed using The Visualization of Similarities Viewer (VOSviewer version 1.6.15, Leiden University, Center for Science and Technology Studies). A minimum threshold of 2 co-authorship papers was applied in co-authorship analysis to filter significant collabora-

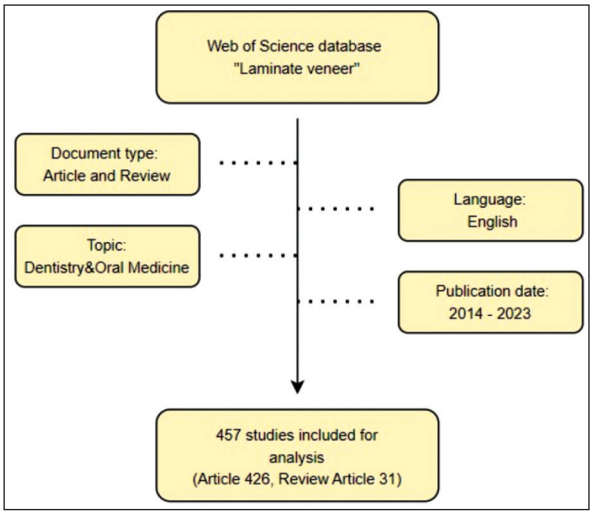

FIGURE 1: Flowchart of literature inclusion

tions. In the keyword map, larger circles indicated the most significant terms, while closely related terms were connected and displayed in similar colors.[10]

RESULTS

The earliest publication in the WoS database under the keyword "Laminate veneer" dates back to 1981. Between 1981-1991, 28 studies were conducted, followed by 62 studies between 1992-2002, 170 studies between 2003-2013, and 457 studies from 2014 to 2023.

Between 2014-2023, 60 countries or regions published research on the topic of LVs and Brazil emerged as the leading country with 105 publications, representing 22.9% of the global output. This dominance is further emphasized by its H-index of 21 and total citation count of 1,515, surpassing other countries such as the USA, which ranked 2nd (Figure 2).

The USA, demonstrated the strongest collaborative network in the field, with a total link strength of 113 (Figure 3). The figure demonstrated a high level of international collaboration, particularly with countries like Brazil and Switzerland.

A total of 592 affiliations contributed to the publication of 457 articles. The highest number of publications came from Universidade Estadual Paulista in Brazil of 23, followed by Universidade De Sao Paulo of 20 and the University of Zurich of 16. However, the total number of citations of universities increases not linearly with the number of publications. Figure 4 provides a list of the top 10 most prolific affiliations.

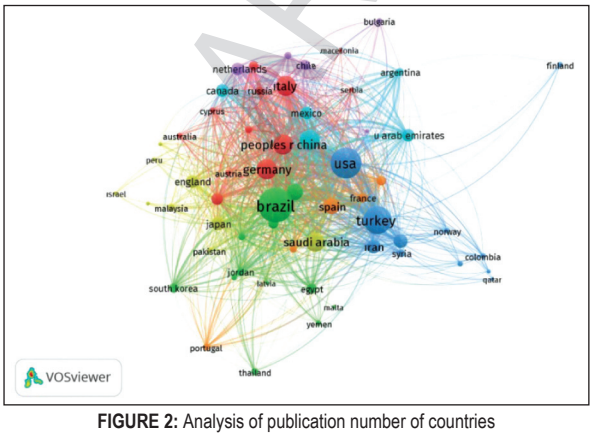

FIGURE 2: Analysis of publication number of countries

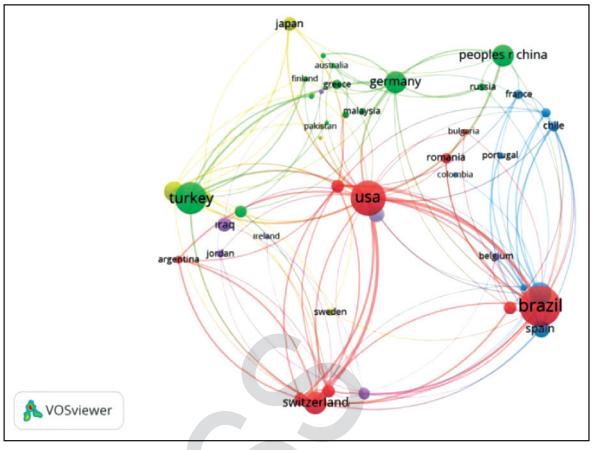

FIGURE 3: Analysis of countries co-authorship

Author data from the publications were analyzed to pinpoint influential scholars in the field of LV in dentistry. One thousand six hundred and forty-six authors have studied this subject (Figure 5).

The top 10 most productive authors and citation numbers are listed in Table 1. Özcan stands out as the most influential researcher in this field with 16 articles and 303 citations, followed by Jurado of 9 articles and Moraes of 8 articles.

Between 2014-2023, a total of 127 journals published articles related to LVs. The top 10 journals by the number of published articles on LVs are listed in Table 2. Journal of Esthetic and Restorative Dentistry is the journal with the most publications on this subject, followed by the Journal of Prosthetic Dentistry and the total number of published articles, constituting 15.5% of all published articles. The Journal of Prosthetic Dentistry had the highest citations of 966.

After excluding duplicate keywords and setting a minimum occurrence of 3 times for each, 121 keywords were subjected to visualization. These keywords were categorized according to years in VOSviewer (Figure 6). The most frequently used keywords in publications about LV were "dental veneers" (n=29), "ceramics" (n=28), and "resin cement" (n=27). These terms have also been commonly used in studies published in recent years. In addition, especially after 2020, the use of terms such as "CAD" and "enamel thickness" is noteworthy.

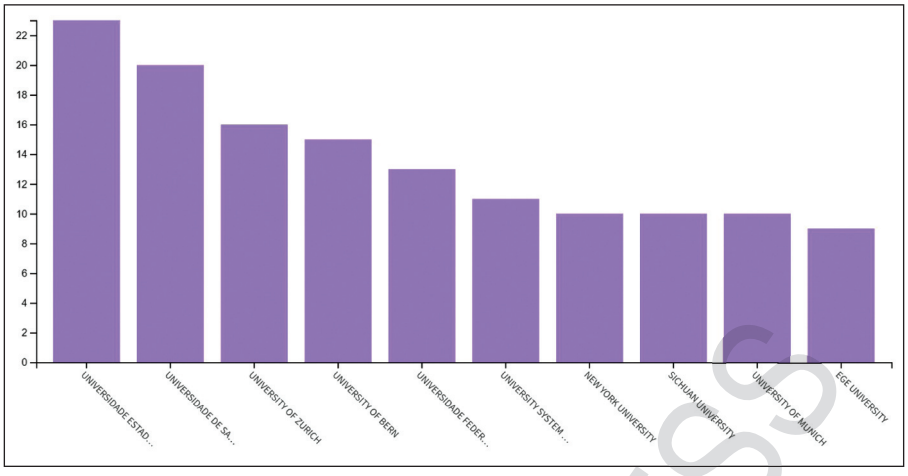

FIGURE 4: Top ten contributing affiliations

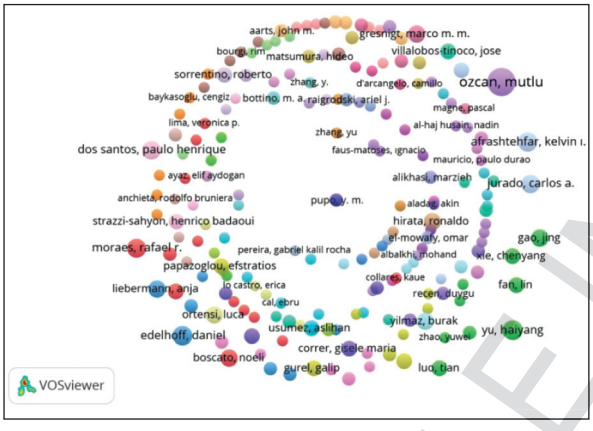

FIGURE 6: Analysis of authors

TABLE 1: Top ten contributing authors

Journal	Number of article
Journal of Esthetic and Restorative Dentistry	36
Journal of Prosthetic Dentistry	35
Operative Dentistry	24
International Journal of Esthetic Dentistry	21
Journal of Prosthodontics	17
Implant Esthetic and Reconstructive Dentistry	
Dental Materials	16
International Journal of Prosthodontics	15
Case Reports in Dentistry	12
Quintessence International	12
Journal of the Mechanical Behavior of Biomedical Materials	11

TABLO 2: Top ten contributing journals

Authors	Number of article	Number of citation	Country
Özcan M.	16	303	Switzerland
Jurado C.	9	46	USA
Moraes R.	8	200	Switzerland
Edelhoff D.	8	95	Germany
Dos Santos PH.	7	50	Brazil
Gresnigt M.	7	234	Netherlands
Haiyang Yu.	7	105	China
Liebermann A.	6	84	Germany
Gonzaga CC.	5	87	Brazil
Boscato N.	5	142	Brazil

DISCUSSION

Previous bibliometric studies in the field of dentistry have been conducted on specific keywords such as 3D printers, post-core and dental ceramics, publications in the core international journal within a certain period within a period or journal of field-specific in dentistry.[11-19] In this study, a current and trending specific topic, LV restorations, is discussed. The previous studies revealed no bibliometric studies and quantitatively evaluated scientific research specifically focused on LVs.

The first study on the subject of LV was in 1981, and when the number of publications last 10 years was examined, it was seen rapidly over time. So, as in similar studies, the last 10 years were included in this study.[20,21]

In the search, 4 articles were non-English (Italian, Spanish, and Turkish) and there were no citations so it was thought that articles had no impact on the results of this study. English language would increase accessibility. So the language was limited to English.

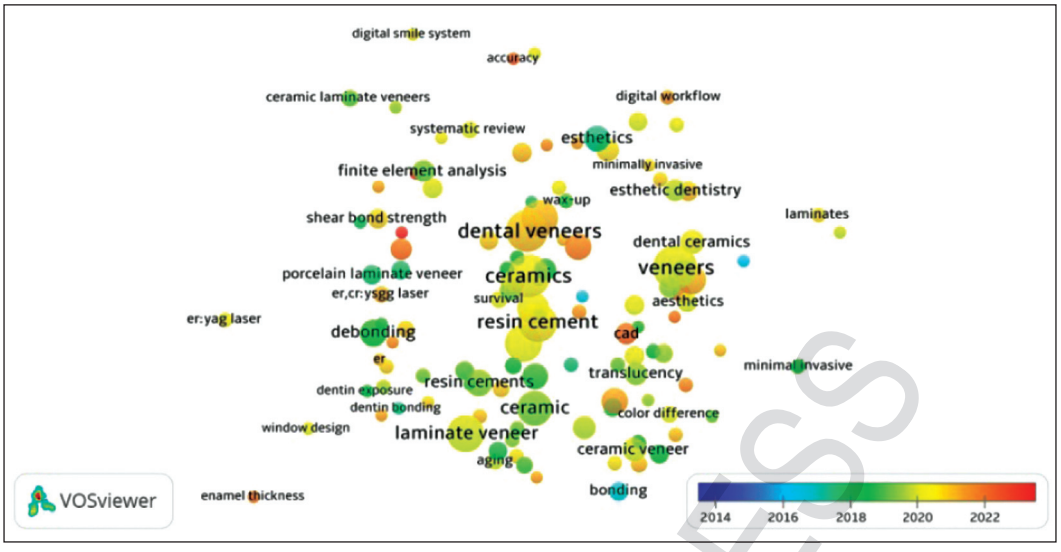

FIGURE 6: Analysis of keywords according to year

Our findings showed that, between 2014-2023, a total of 457 articles on LVs in Dentistry&Oral Medicine were published by 1,646 authors across 592 affiliations in 60 different countries.

Brazil was the country with the most publications and this trend may be due to Brazil having the 2nd-largest number of dental students worldwide, which has greatly contributed to its research productivity in the field.[12] This result is consistent with the leadership of Brazil and the USA in aesthetic dentistry, minimally invasive dentistry, and dental ceramics.[13,22,23]

While publication numbers indicate researcher productivity, citation counts assess scientific impact by measuring how frequently later articles reference a given work.[24] The author with the most publications in the study is also the author with the most citations.

Keywords are words or word groups that describe the subject of a study and guide authors. The use of true keywords makes it easier to reach the relevant article.[23] The most frequently used keywords were “dental veneers”, “ceramics”, and “resin cement”. Our finding that “dental veneers” is the most frequently used keyword aligns with similar bibliometric studies in the field of dental ceramics.[13] It is thought that this situation is because there are more studies examining the effect of the material on the success of LVs. Additionally, the growing emphasis on “CAD” and “enamel thickness” post-2020 suggests a shift toward digital technologies and minimally invasive techniques, which was not evident in earlier studies.

Limitations of this study included relying only on the WoS database for searches, this approach may have introduced selection bias. However, since WoS covers over 34,000 leading journals, excluding others is unlikely to substantially affect the bibliometric trends observed in LV research.[25] Future studies should incorporate multiple databases and include non-English literature to provide a broader perspective. Specifically, incorporating different databases (such as Scopus and PubMed) could provide access to a broader range of publications, enhancing the generalizability of the findings. Additionally, self-citation analysis and citations from textbooks were not incorporated. In addition to providing valuable insights into tendencies related to LV in dentistry, the findings of this study can guide clinicians by indicating which topics (e.g., CAD-CAM applications, material durability, enamel thickness) are most frequently investigated. Therefore, the results may contribute not only to the academic literature but also to clinical practice by helping clinicians better understand the directions and priorities of current LV research.

CONCLUSION

This study provided a comprehensive overview of global research trends in LVs and the following conclusions were drawn:

1. Studies evaluating the success of developed materials in LV restorations with different parameters are still a current issue.

2. The number of studies on LV restorations in the field of dentistry is increasing day by day. Future research could focus on expanding the application of CAD-CAM technologies and exploring the long-term clinical performance of innovative materials in LV restorations.

Data Accessibility

The data obtained and analyzed in this study will be stored securely for a period of 5 years.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Nurşen Şahin;* ***Design:*** *Çağrı Ural, Nurşen Şahin;* ***Control/Supervision:*** *Çağrı Ural, Nurşen Şahin;* ***Analysis and/or Interpretation:*** *Çağrı Ural, Nurşen Şahin;* ***Literature Review:*** *Çağrı Ural, Nurşen Şahin;* ***Writing the Article:*** *Çağrı Ural, Nurşen Şahin;* ***Critical Review:*** *Çağrı Ural, Nurşen Şahin.*

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