

## ORIGINAL RESEARCH ARTICLE

# Scientific Impact of Conventional and Novel Cigarette Products on Dentistry: A Bibliometric Mapping of Publications

Melek Almila Erdoğan  <sup>1</sup>✉, \*<sup>1</sup>Department of Prosthodontics, Gülhane Faculty of Dentistry, University of Health Sciences, Ankara, Türkiye

\*Corresponding Author; almilacali@gmail.com

## Abstract

**Purpose:** This study aims to analyze the global trends of scientific publications examining the impact of conventional and novel cigarette products on dental materials using bibliometric methods.

**Materials and Methods:** A search in the Web of Science (WOS) database was conducted using the keywords (“cigarette” OR “smoking” OR “e-cigarette” OR “electronic cigarette” OR “heated tobacco products”) AND (“dental material” OR “dental tissue” OR “enamel” OR “dentin” OR “resin composite” OR “dental composite” OR “dental porcelain”). VOSviewer (v1.6.20) software and Biblioshiny (v2.0) in RStudio (R v4.2.2) were utilized to conduct a bibliometric analysis of global research trends on the effects of smoking on dentistry material.

**Results:** Information has been provided about the 273 articles obtained from the WOS database and the 9,606 citations they received. The average number of citations per article is 35, and the H-index is 49. Since 2010, both the number of articles and citations have increased. As a result of the keyword analysis, the most frequently used and interconnected conceptual clusters in the literature include terms such as “periodontitis,” “guided tissue regeneration,” and “gingival recession.” The United States, Brazil, and Italy are the leading countries publishing the most articles on this topic, contributing to approximately 50% of the total. Most of the articles (86%) are categorized in the SCI-Expanded category.

**Conclusions:** Studies investigating the effects of cigarettes on dental-periodontal tissues and dental materials are predominantly scientifically impactful and reliable publications. Research on this topic is increasingly gaining popularity and attracting attention.

**Keywords:** Bibliometric analysis; Cigarette smoking; Dental materials; Electronic Nicotine Delivery Systems; Periodontitis

## Introduction

As reported by the World Health Organization (WHO), tobacco and nicotine addiction is one of the most common health threats, affecting more than 1.3 billion people who use tobacco and tobacco products.<sup>1</sup> Although conventional cigarettes remain the most common method of nicotine consumption worldwide, the use of products such as “electronic nicotine delivery systems (ENDS),” popularly referred to as electronic cigarettes, and “heated tobacco products (HTP)” has become increasingly widespread in recent years, especially among adolescents.<sup>1–3</sup>

Periodontitis, a persistent inflammation resulting from bacterial activity, leads to the destruction of teeth and periodontal tissues, ultimately resulting in tooth and bone loss. Similarly, the same pathological mechanism contributes to the failure of dental implants placed within the bone by causing damage to the surrounding peri-implant tissues.<sup>4</sup> Although periodontitis and peri-implantitis

are bacterial infections associated with dental biofilm, they are also influenced by systemic and environmental variables such as patient age, inflammatory disorders like diabetes, neoplasms, and cigarette consumption.<sup>4,5</sup>

The correlation between conventional cigarette consumption and periodontitis has been extensively studied in literature, with compelling evidence demonstrating that the prevalence of periodontitis increases in smokers.<sup>6</sup> The rising prevalence of electronic cigarettes has prompted investigations into their potential associations with periodontal health; nonetheless, the evidence remains inadequate.<sup>7</sup>

Owing to the rising prevalence of smoking worldwide and its significant association with various aspects of dentistry, understanding current research trends in dental literature has become even more important. Although patients with periodontitis who smoke may experience tooth or implant loss due to the disease, they often continue smoking because of the high addiction poten-

tial of nicotine found in cigarettes.<sup>8</sup> Therefore, in the field of dentistry, not only the effects of smoking on periodontal tissues but also the impact of smoking on restorative materials used in prosthetic treatments following tissue loss have been extensively investigated in the literature.<sup>6,9,10</sup> Despite numerous articles in the literature investigating the impact of cigarettes on periodontal tissues,<sup>6–8</sup> teeth,<sup>11–14</sup> or dental materials,<sup>15–17</sup> as original studies,<sup>18</sup> scoping reviews,<sup>10</sup> or systematic review and meta-analyses,<sup>7</sup> to the best of the author's knowledge, a bibliometric analysis of these publications has not been performed previously.

Bibliometric analysis was first introduced into the literature by Alan Pritchard in 1969.<sup>19</sup> This method aims to strengthen research frameworks and field directions by summarizing scientific contributions on specific topics and tracking research trends. With recent improvements in database access and indexing systems, conducting bibliometric analysis has become significantly easier.<sup>20–22</sup>

Therefore, the aim of this study is to perform a bibliometric analysis of global trends, impact, and future directions of publications that analyze the effects of conventional and novel cigarette types on dental-periodontal tissues or dental materials. The null hypothesis of this study is that (1) there is no observable increase in the quantity of publications or citations over time, (2) there is no notable category into which these publications are indexed, (3) there is no clear thematic clustering based on keyword analysis, and (4) there is no detectable high contribution from particular authors or countries in the domain of cigarette-related dental research.

## Material and Methods

A systematic data collection method, search strategy, and network analysis software were employed to ensure the study's reliability and the results' accuracy. These strategies facilitated the acquisition and examination of the most current and comprehensive data available in the literature. The examination of this data offers insights into contemporary trends and advancements concerning the future and implications of research on the effects of cigarette consumption on dental materials throughout the scientific community. Global publishing patterns on the impact of nicotine use items on dental materials have been discerned by analyzing numerous elements, including prominent researchers, countries, and commonly utilized keywords.

### Data Collection Method and Search Strategy

This bibliometric analysis was conducted using the Web of Science Core Collection (WOS, Clarivate Analytics, Philadelphia, PA, USA) database. The study focused on identifying global publication trends and future research directions related to the effects of conventional and novel cigarette products on dental materials, covering the period from 2010 to 2025. The analysis included publications published from January 1, 2010, forward and was finalized on April 15, 2025. A structured search strategy was applied using the following keyword combination: ("cigarette" OR "smoking" OR "e-cigarette" OR "electronic cigarette" OR "heated tobacco products") AND ("dental material" OR "dental tissue" OR "enamel" OR "dentin" OR "resin composite" OR "dental composite" OR "dental porcelain"). The literature screening and study selection process is summarized in the flow diagram presented in Figure 1.

The initial search yielded 361 records. After removing irrelevant items, publications dated before 2010, and non-article types (e.g., reviews, editorials, conference papers), a total of 273 research articles were included in the final analysis.

Data extraction was based on the following bibliometric parameters: journal name, article title, author(s), publication year, and citation count. Full-text access to the selected articles was obtained via the online library and digital resources of University of Health



Figure 1. PRISMA Flowchart illustrating the identification, screening, and inclusion of studies in the study

Sciences. The search was performed in English.

WOS was selected for its comprehensive indexing of high-impact academic journals across multiple disciplines, making it an ideal source for interdisciplinary bibliometric research. The retrieved data were analyzed using bibliometric techniques to evaluate publication growth over time, leading countries and institutions, and keyword co-occurrence patterns. All records were reviewed systematically to ensure data integrity and relevance to the study scope.

### Network Analysis

In this bibliometric analysis, VOSviewer (version 1.6.20, Leiden University, The Netherlands) and Biblioshiny (version 2.0), running on RStudio (R version 4.2.2), were used to analyze global trends and identify key research topics related to the effects of various types of smoking on dental materials.

VOSviewer was utilized to visualize collaboration networks, research trends, and emerging areas. Open-source tools developed in the R environment, Bibliometrix and Biblioshiny, facilitated the quantitative and visual analysis of bibliometric indicators such as publication count, citation frequency, and keyword occurrence.

To ensure the accuracy of the co-authorship and citation analyses, a data normalization process was implemented prior to the analysis. This process involved the manual inspection of author lists generated by the VOSviewer and Biblioshiny software. Different variations of the same author's name (e.g., "Cortellini P" and "Cortellini, Paolo") were identified and merged into a single, consistent identity. This author's name disambiguation process ensures

**Table 1.** Categories of publications

Research Areas	Record Count	% of 273
Dentistry Oral Surgery Medicine	188	68.864
Public Environmental Occupational Health	14	5.128
Medicine General Internal	12	4.396
Environmental Sciences	10	3.663
Multidisciplinary Sciences	10	3.663
Pediatrics	8	2.930
Toxicology	8	2.930
Biotechnology Applied Microbiology	7	2.564
Materials Science Biomaterials	7	2.564
Medicine Research Experimental	6	2.198
Biology	5	1.832
Pharmacology Pharmacy	5	1.832
Anatomy Morphology	4	1.465
Anthropology	4	1.465
Optics	4	1.465

that each author is represented as a single entity in the analysis, thereby increasing the reliability of the network analyses.

### Bubble Maps

In the bibliometric analyses conducted with VOSviewer, bubble maps were used to illustrate the clustering of research topics based on the frequency of occurrence in the literature. Each keyword or group of keywords is represented as a "bubble," with the size of the bubble corresponding to the frequency of that keyword's appearance in the dataset.

Bubbles are color-coded, where each color indicates a different thematic cluster. Keywords within the same cluster tend to be closely positioned, reflecting their co-occurrence and topical relevance. These visualizations facilitate the identification of dominant themes and relationships within the field.

### Results

Based on the search results obtained from the WOS database, a total of 273 original research articles examining the effects of cigarette products on dental-periodontal tissues and dental materials were included in the analysis. An evaluation of the distribution of the included publications by research area revealed that most of the articles were categorized under "Dentistry, Oral Surgery & Medicine" (68.7%). This was followed by "Public, Environmental & Occupational Health" (5.1%), "Medicine, General & Internal" (4.4%), and "Multidisciplinary Sciences" (3.7%). The remaining publications were classified under various other disciplines. A detailed breakdown of the research areas is presented in Table 1. Additionally, these articles received a total of 9,606 citations, and when self-citations were excluded, the number of citations was 9,275. The average number of citations per article was calculated as 35. The H-index for this body of literature was found to be 49.

The distribution of publications by index category is presented in Table 2. An examination of the Web of Science indexes revealed that most of the analyzed articles were published in journals indexed under the Science Citation Index Expanded (SCI-Expanded) (86.1%). This ranking was followed by the Emerging Sources Citation Index (ESCI) (12.1%) and the Social Sciences Citation Index (SSCI) (6.2%).

Since 2010, a marked upward trend has been observed in both the annual number of publications and the citations received. This trend indicates a growing interest and increasing scientific attention to this topic over the years. The distribution of publications by year and the citation trends are presented in detail in Figure 2.

As a result of the keyword analysis, the most frequently used and strongly interconnected conceptual clusters in the literature were

**Table 2.** Distribution of publications according to WOS indexes

WOS Indexes	Record Count	% of 273
Science Citation Index Expanded (SCI-Expanded)	235	86.081
Emerging Sources Citation Index (ESCI)	33	12.088
Social Sciences Citation Index (SSCI)	17	6.227
Conference Proceedings Citation Index - (CPCI-S)	7	2.564

identified as including terms such as "smoking," "periodontitis," "dental caries," "tobacco," "cigarette smoking," "guided tissue regeneration," and "gingival recession." The terms "dental enamel," "dental materials," "color," and "tooth bleaching" were prevalent with "smoking" nearby. It is linked to the terms "periodontitis," "alveolar bone loss," and "gingivitis" (Figure 3).

Table 3 presented the countries with a minimum of 15 publications, the leading research institutions, and the top 15 most productive authors on the topic. An analysis of publication output by country revealed that the United States (USA) ranked first with a total of 61 publications (22.3%). The USA was followed by Brazil (n=42; 15.4%), Italy (n=32; 11.7%), and Switzerland (n=23; 8.4%). Geographical distribution of publications is visually represented in Figure 4. This visualization shows the geographical distribution of scientific publications related to the effects of conventional and novel cigarette products on dental materials. Countries are shaded based on their publication output: darker blue tones indicate more publications, while grey areas represent countries with no identified studies in this field during the 2010–2025 period.

Among the 551 records analyzed, institutions such as Universidade de São Paulo (5.1%), University of Rochester (4.0%), Universidade Estadual de Campinas (3.7%), and University of Bern (3.3%) emerged as the leading research institutions with the highest number of publications. Most of the analyzed institutional collaborations were found to be centered in the United States, followed by Switzerland, Italy, and Brazil (Figure 5).

The most prolific authors among the total of 273 publications were analyzed. Cortellini P stands out as the most productive author, contributing to 6 publications, which accounts for 2.198% of the total. He is followed by 8 authors, including Hoeng J, Nieri M, and Peitsch MC, each contributing to 5 publications, representing 1.832% of the total output. The remaining authors listed have each contributed 4 publications (1.465%), indicating that research activity in this field is distributed across a wide range of contributors. This table is significant for identifying the most active and influential researchers in the area under study. The list includes only the top 15 authors, while in total, 1,298 unique authors contributed to

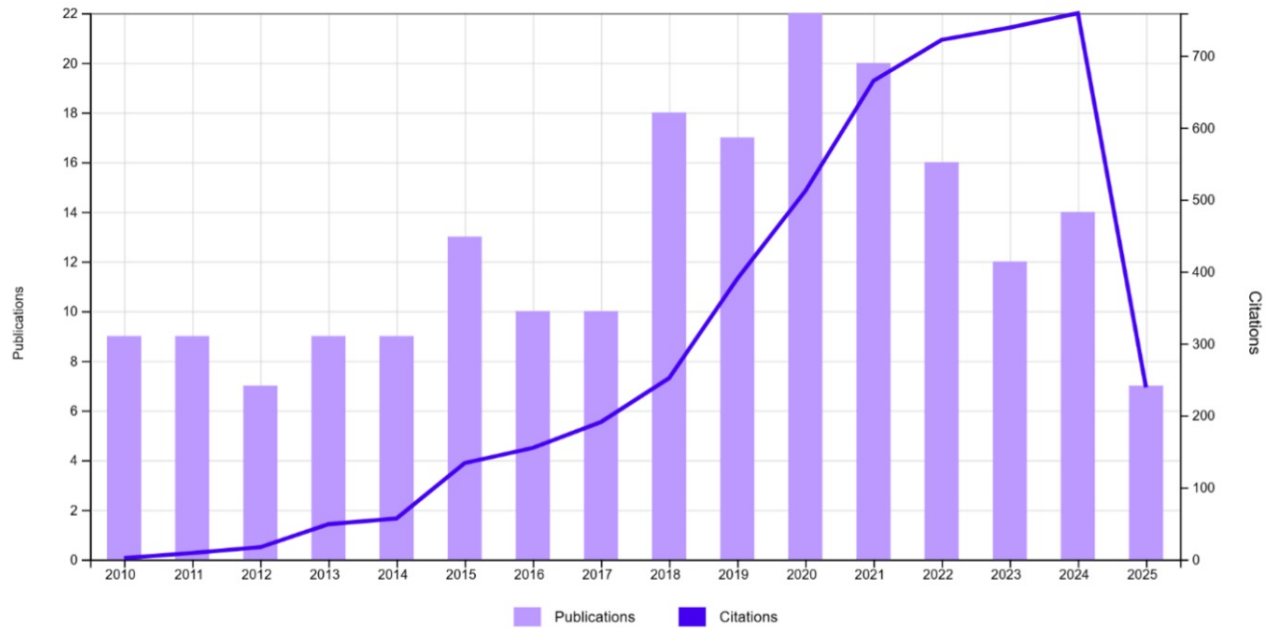


Figure 2. Frequency of publications and citations by year (01.01.2025 - 15.04.2025)

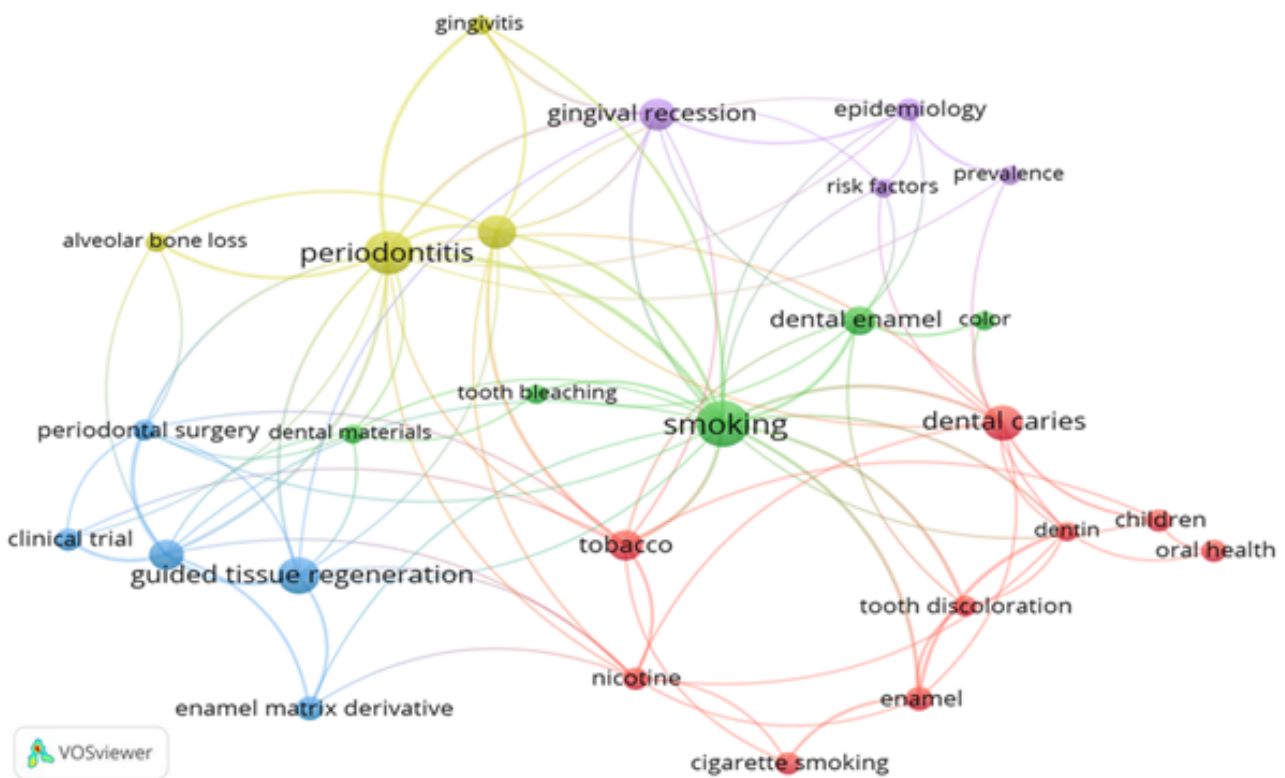


Figure 3. Visualization of keyword co-occurrence related to cigarette smoking and dental-periodontal tissues and dental materials. (Node size reflects the frequency of keyword usage, while the proximity and connecting lines represent the strength of association between terms. Clusters are color-coded to indicate thematically related keyword groups. This map, generated using VOSviewer.)

the analyzed publications.

## Discussion

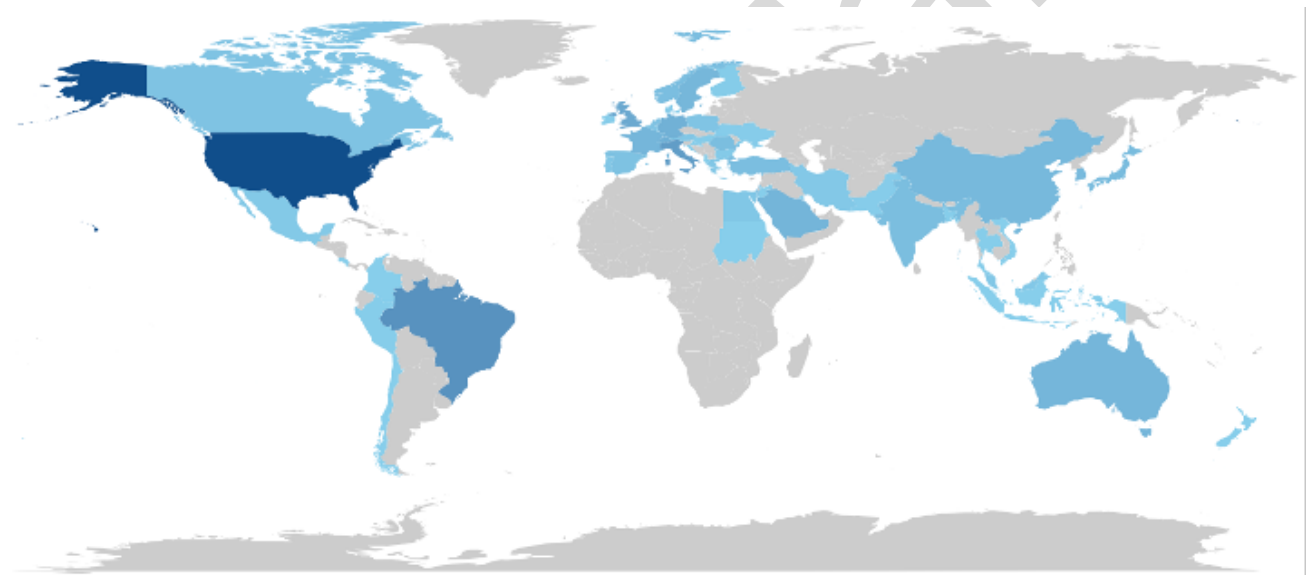
This study aimed to analyze the scientific impact of conventional and novel cigarette products on dental research via bibliometric

analysis. Based on the results of this study, the null hypothesis, which stated that there is no observable increase in the quantity of publications or citations over time, there is no notable category into which these publications are indexed, there is no clear thematic clustering based on keyword analysis, and there is no detectable high contribution from particular authors or countries in the domain of cigarette-related dental research, was fully rejected.



**Table 3.** Comprehensive productivity overview of countries with  $\geq 15$  publications, affiliations, and top authors

Countries			Affiliations			Authors		
Record Count	% of 273		Record Count	% of 273		Record Count	% of 273	
USA	61	22.344	Universidade de Sao Paulo	14	5.128	Cortellini P	6	2.198
Brazil	42	15.385	University of Rochester	11	4.029	Hoeng J	5	1.832
Italy	32	11.722	Universidade Estadual de Campinas	10	3.663	Nieri M	5	1.832
Switzerland	23	8.425	University of Bern	9	3.297	Peitsch MC	5	1.832
England	22	8.059	University of London	9	3.297	Ren YF	5	1.832
Germany	18	6.593	Egyptian Knowledge Bank (EKB)	7	2.564	Rotundo R	5	1.832
Sweden	15	5.495	Karolinska Institutet	6	2.198	Sculean A	5	1.832
France	14	5.128	King Saud University	6	2.198	Zanetti F	5	1.832
China	14	5.128	National Kapodistrian University of Athens	6	2.198	Zhao XY	5	1.832
Japan	12	4.396	Pennsylvania Common Syst of Higher Edu (PCSHE)	6	2.198	Aguiar FHB	4	1.465
Saudi Arabia	12	4.396	Assistance Publique - Hôpitaux de Paris (APHP)	5	1.832	Bouchard P	4	1.465
Turkiye	11	4.029	Augusta University	5	1.832	Cairo F	4	1.465
Australia	10	3.663	King's College London	5	1.832	Cosyn J	4	1.465
Norway	9	3.297	Sorbonne Université	5	1.832	De Sanctis M	4	1.465

**Figure 4.** Countries' Scientific Production (This map shows that as the color turns dark blue, the number of studies in this area increases, while gray areas represent areas where no studies have been conducted. The visualization generated using Biblioshiny, the web interface of the Bibliometrix R package.)

Bibliometric analysis, or scientific mapping, is a method that aims to analyze published works within a topic by examining bibliographic data on a large scale to analyze the structural and relational characteristics of literature. Bibliometric analysis focuses on bibliometric data, including keywords, authors, citations, and geographic locations, among other factors. It does not evaluate the quality of the literature; rather, it provides a comprehensive overview of the features of the knowledge base, thus enhancing rather than replacing other review methodologies.<sup>20–22</sup>

According to the WHO, nicotine addiction is one of the greatest health threats affecting many people. Nicotine in tobacco is highly addictive, and tobacco consumption significantly contributes to cardiovascular and respiratory disorders, over 20 distinct types or subtypes of cancer, and numerous other devastating health issues.<sup>1</sup> Furthermore, the close relationship between cigarette consumption and diseases such as periodontitis is a subject that has been known and researched for an extended period.<sup>6</sup> Since the early 2000s, the rising popularity of novel cigarette products—driven largely by social media and influencers—has played a significant

role in the spread of this threat.<sup>1,2</sup> WHO data indicates that in 88 countries, there is no minimum legal age for purchasing these novel cigarette products, and in 74 countries, there are no legal regulations regarding their marketing, an issue that is particularly concerning children and adolescents.<sup>2</sup> The rising prevalence of next-generation cigarette products led to an associated increase in studies investigating their impact on different disciplines of dentistry.<sup>7,13,15,23–27</sup>

Therefore, this bibliometric study aimed to highlight the global increase in global research trends in scientific publications examining the effects of traditional and novel cigarette products on dental-periodontal tissues and dental materials and their scientific implications in the field of dentistry.

In this study, using the WOS database, a total of 273 original research articles (01.01.2010–15.04.2025) examining the effects of cigarette products on dental-periodontal tissues and dental materials were included in the analysis. VOSviewer was utilized as advanced data visualization software to systematically examine collaboration networks, research patterns, and prospective future

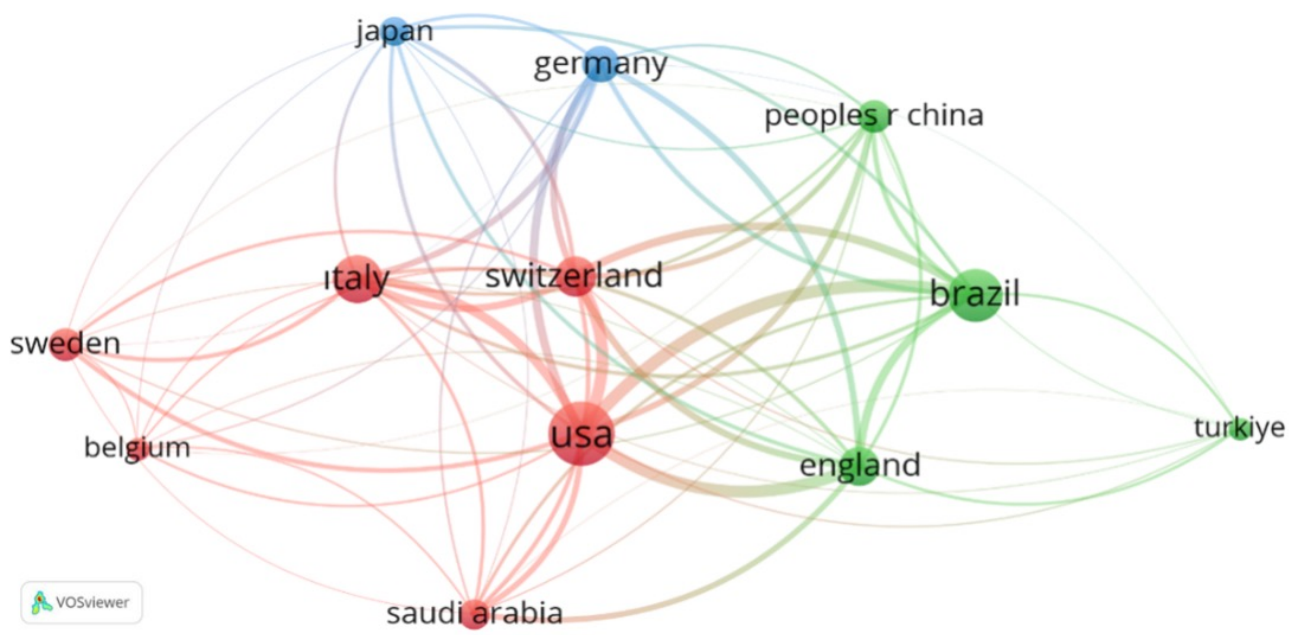


Figure 5. The international collaboration network visualization. (Cooperation between countries is realized with lines whose thickness represents the strength of cooperation, and the size of the circles/text represents the size of international cooperation. This map, generated using VOSviewer.)

research topics.<sup>28</sup> Additionally, Bibliometrix and Biblioshiny, open-source research software packages operating in the R programming language, provided an interactive platform for conducting bibliometric and visual analyses. These tools not only enhanced the accuracy and reliability of the study but also facilitated a more comprehensive and precise interpretation of the collected data. The analyses presented diagrams and maps that illustrated key points of the research, the progression of the research process, and the publication dynamics over time, offering a broad perspective on the development of studies in this field.<sup>29</sup>

According to the keyword combination ("cigarette" OR "smoking" OR "e-cigarette" OR "electronic cigarette" OR "heated tobacco products") AND ("dental material" OR "dental tissue" OR "enamel" OR "dentin" OR "resin composite" OR "dental composite" OR "dental porcelain"), most of the publications included in the research are in the "Dentistry, Oral Surgery & Medicine" category (68.7%). The latter group is followed by the "Public, Environmental & Occupational Health" category (5.1%). This distribution shows that research focuses primarily on dentistry, but the subject also receives attention in public health and general medicine (Table 1). Furthermore, in this bibliometric analysis, it is observed that the 273 studies examined have a high H-index and a high citation count. This indicates that the contributions of the studies to the field are strong, they have a significant impact on other research in literature, and they have considerably supported scientific progress in this area.

The bibliometric analysis indicates that 86.081% of the publications are indexed in the SCI-Expanded category, while 12.088% are indexed in the ESCI category (Table 2). This distribution indicates that research on the impact of cigarette products on dentistry is predominantly published in esteemed journals with high impact factors.

Examining Figure 2, it can be shown that the quantity of publications assessed peaked in 2020 and then rose once more in 2024. Moreover, 2024 marked the year with the largest number of citations. This bibliometric analysis encompasses the period up to the first quarter of 2025, resulting in a very low count of articles for that year; however, this figure is anticipated to rise later in the year. This circumstance indicates that research on the impact of tobacco products on dentistry has regained significance and interest

is on the rise. The selection of key terms including "periodontitis," "guided tissue regeneration," and "gingival recession", has yielded outcomes closely associated with these concepts, indicating that cigarettes have considerable significance for periodontology. These keywords indicate an important clinical correlation between smoking and periodontal tissues, along with aspects of aesthetic dentistry. The co-occurrence of keywords such as "dental enamel," "tooth bleaching," and "tooth discoloration" alongside terms like "smoking" and "tobacco"—despite their lesser node sizes—indicates an increasing significance of smoking within the topic of prosthetic and aesthetic dentistry (Figure 3). In this study, in line with the existing literature, it is seen that authors with the highest number of publications on the subject, such as Cortellini P and Hoeng J, are focusing on periodontology, while authors such as Zanetti F and Zhao XY are focusing on dental tissues and dental materials in relation to cigarette products (Table 3).

In a systematic review performed by D'Ambrosio et al., it was reported that electronic cigarettes may attenuate the clinical inflammatory signs of periodontitis and, hypothetically, peri-implantitis when compared to conventional tobacco smoke. However, it was also noted that due to their nicotine content, new-generation cigarettes may harm periodontal and peri-implant health.<sup>5</sup> On the other hand, studies aiming to prosthetically rehabilitate teeth and tissue loss resulting from periodontitis in smokers have rapidly gained popularity in the field of dental materials. Numerous studies have investigated not only the effects of conventional cigarettes but also those of electronic cigarettes and non-heated tobacco products on dental materials.<sup>9,10,15</sup> However, particularly with electronic cigarettes, various limitations and inconsistent results are observed in studies due to factors such as their incomplete legal regulation, the inability to control substances added to nicotine liquids, and manufacturers not disclosing their ingredient formulas.<sup>15,30</sup>

The research data indicates that the countries with the highest publication rates on the topic are the USA, Switzerland, Brazil, and Italy, with the USA exhibiting the most collaboration. This indicates that study on the impact of cigarette products on dentistry is particularly focused in these regions (Table 3, Figure 4, Figure 5). The examined articles were authored by researchers from 59 distinct countries, with Turkey notably contributing to the area, ranking 11th in publication volume.

This study indicates a worldwide rise in scientific publications examining the impact of cigarette products on dentistry. To the best of the author's knowledge, this is the first study that researched the bibliometric analysis of cigarette products' effects on the dentistry field. It aims to identify global trends and clusters in research examining the impact of cigarette products on dental-periodontal tissues and dental materials, analyzing which topics are being prioritized and which countries contribute most to this field. Additionally, the study identifies key journals, authors, and foundational works and offers insights on prospective future research directions in this field, including which topics are likely to gain prominence and which researchers may emerge as leaders.

A limitation of this study is that bibliometric analysis is primarily used to identify trends and patterns in literature; it does not assess the correctness or quality of the original data. Therefore, more comprehensive studies on the research topic should be conducted, and similar analyses should be performed using different databases. Additionally, bibliometric analysis does not aim to assess applicability, as it is intended only to analyze existing literature data and provide a general overview of specific topics.

## Conclusion

The rising usage of both conventional and novel cigarette products in recent years has rendered investigation of their effects on dentistry an emerging field of research. The study has revealed that the publications associated with this topic are published in highly esteemed journals with a high impact factor and have a high number of citations. While the majority of research involves periodontology, the importance of this area is also growing in prosthetics and aesthetic dentistry. Further investigation is required about the impact of these products on periodontal tissues, dental hard tissues, and restorative dental materials, to reduce aesthetic concerns and enhance the oral health of patients who utilize conventional or novel cigarette products.

## Ethical Approval

This study is a bibliometric analysis that does not include human or animal experiments. Therefore, ethics committee approval is not required.

## Acknowledgements

None.

## Financial Support

The author received no financial support for the research, authorship, and/or publication of this article.

## Author Contributions

All aspects of the article : M.A.E.

## Conflict of Interest

The author declared no potential conflicts of interest concerning for to the research, authorship, and/or publication of this article.

## Authors' ORCID(s)

M.A.E. 0000-0003-1161-6137

## References

1. Organization WH. Tobacco [Web Page]. Available from: <https://www.who.int/news-room/fact-sheets/detail/tobacco>.
2. Organization WH. Tobacco: E-cigarettes [Web Page]. Available from: <https://www.who.int/news-room/questions-and-answers/item/tobacco-e-cigarettes>.
3. Organization WH. WHO global report on trends in prevalence of tobacco use 2000–2025. World Health Organization; 2020.
4. Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. *J Clin Periodontol*. 2018;45 Suppl 20:S246–S266. doi:10.1111/jcpe.12954.
5. D'Ambrosio F, Pisano M, Amato A, Iandolo A, Caggiano M, Martina S. Periodontal and Peri-Implant Health Status in Traditional vs. Heat-Not-Burn Tobacco and Electronic Cigarettes Smokers: A Systematic Review. *Dent J (Basel)*. 2022;10(6). doi:10.3390/dj10060103.
6. Leite FRM, Nascimento GG, Scheutz F, López R. Effect of Smoking on Periodontitis: A Systematic Review and Meta-regression. *Am J Prev Med*. 2018;54(6):831–841. doi:10.1016/j.amepre.2018.02.014.
7. Shabil M, Khatib MN, Ballal S, Bansal P, Tomar BS, Ashraf A, et al. The impact of electronic cigarette use on periodontitis and periodontal outcomes: a systematic review and meta-analysis. *BMC Oral Health*. 2024;24(1):1197. doi:10.1186/s12903-024-05018-7.
8. Apatzidou DA. The role of cigarette smoking in periodontal disease and treatment outcomes of dental implant therapy. *Periodontol 2000*. 2022;90(1):45–61. doi:10.1111/prd.12449.
9. Karanjkar RR, Preshaw PM, Ellis JS, Holliday R. Effect of tobacco and nicotine in causing staining of dental hard tissues and dental materials: A systematic review and meta-analysis. *Clin Exp Dent Res*. 2023;9(1):150–164. doi:10.1002/cre2.683.
10. Paolone G, Pavan F, Guglielmi PC, Scotti N, Cantatore G, Vichi A. In vitro procedures for color stability evaluation of dental resin-based composites exposed to smoke: A scoping review. *Dent Mater J*. 2022;41(6):791–799. doi:10.4012/dmj.2022-106.
11. Dalrymple A, Badrock TC, Terry A, Barber M, Hall PJ, Thorne D, et al. Assessment of enamel discoloration in vitro following exposure to cigarette smoke and emissions from novel vapor and tobacco heating products. *Am J Dent*. 2018;31(5):227–233.
12. Dalrymple A, Bean EJ, Badrock TC, Weidman RA, Thissen J, Coburn S, et al. Enamel staining with e-cigarettes, tobacco heating products and modern oral nicotine products compared with cigarettes and snus: An in vitro study. *Am J Dent*. 2021;34(1):3–9.
13. Zanetti F, Zhao X, Pan J, Peitsch MC, Hoeng J, Ren Y. Effects of cigarette smoke and tobacco heating aerosol on color stability of dental enamel, dentin, and composite resin restorations. *Quintessence Int*. 2019;50(2):156–166. doi:10.3290/j.qi.a41601.
14. Zhao X, Zanetti F, Wang L, Pan J, Majeed S, Malmstrom H, et al. Effects of different discoloration challenges and whitening treatments on dental hard tissues and composite resin restorations. *J Dent*. 2019;89:103182. doi:10.1016/j.jdent.2019.103182.
15. Erdogan MA, Kalyoncuoglu Ü T, Yilmaz Erdemli B. Comparative effects of conventional and electronic cigarettes on discoloration and surface roughness of gingiva-colored dental materials. *J Prosthodont*. 2025;34(5):511–519. doi:10.1111/jopr.14054.
16. Mahmoud AZ, EL-Attar MS, Abu Saied MAA, Hassan IS. Effect of electronic cigarettes smoking on color stability of cad/cam acrylic resin: in vitro study. *Alexandria Dental Journal*. 2023;48(3):160–165. doi:10.21203/rs.3.rs-1577546/v1.

17. Sonkaya E, Soygun K, Kahraman Ö C. Does Cigarette Smoke Affect Permanent Resin-Based Crown Materials? *J Esthet Restor Dent*. 2025;37(2):586–594. doi:10.1111/jerd.13403.
18. Ayaz EA, Aladağ S. Effect of cigarette smoke and denture cleansers on the surface properties and color stability of CAD-CAM and conventional denture base resins. *Dent Mater J*. 2023;42(2):167–176. doi:10.4012/dmj.2022-117.
19. Pritchard A. Statistical bibliography or bibliometrics. *Journal of documentation*. 1969;25:348.
20. Hemmingsen MN, Lau A, Larsen A, Ørholt M. The role of bibliometric analyses in plastic surgery—advantages and disadvantages. *Gland Surgery*. 2023;12(7):87374–87874. doi:10.21037/gs-23-199.
21. Koo M, Lin SC. An analysis of reporting practices in the top 100 cited health and medicine-related bibliometric studies from 2019 to 2021 based on a proposed guidelines. *Heliyon*. 2023;9(6). doi:10.1016/j.heliyon.2023.e16780.
22. Pan HLW, Wiens PD, Moyal A. A bibliometric analysis of the teacher leadership scholarship. *Teaching and Teacher Education*. 2023;121:103936. doi:10.1016/j.tate.2022.103936.
23. Alandia-Roman CC, Cruvinel DR, Sousa AB, Pires-de Souza FC, Panzeri H. Effect of cigarette smoke on color stability and surface roughness of dental composites. *J Dent*. 2013;41 Suppl 3:e73–9. doi:10.1016/j.jdent.2012.12.004.
24. Alrabeah G, Habib SR, Alamro NM, Alzaaqa MA. Evaluation of the Effect of Electronic Cigarette Devices/Vape on the Color of Dental Ceramics: An In Vitro Investigation. *Materials (Basel)*. 2023;16(11). doi:10.3390/ma16113977.
25. El Shafei SF, Amin AH, Abdelghaffar EG, Moataz S, Makkeyah F, Shamel M, et al. The effect of cigarette smoking and heated tobacco products on different denture materials; an in vitro study. *BMC Oral Health*. 2025;25(1):179. doi:10.1186/s12903-025-05448-x.
26. Pintado-Palomino K, de Almeida C, Oliveira-Santos C, Pires-de Souza FP, Tirapelli C. The effect of electronic cigarettes on dental enamel color. *J Esthet Restor Dent*. 2019;31(2):160–165. doi:10.1111/jerd.12436.
27. Takeuchi CY, Corrêa-Afonso AM, Pedrazzi H, Dinelli W, Palma-Dibb RG. Deposition of lead and cadmium released by cigarette smoke in dental structures and resin composite. *Microsc Res Tech*. 2011;74(3):287–91. doi:10.1002/jemt.20903.
28. Van Eck NJ, Waltman L. VOSviewer manual [Generic]; 2016. Available from: [https://www.vosviewer.com/documentation/Manual\\_VOSviewer\\_1.6.19.pdf](https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.19.pdf).
29. Aria M, Cuccurullo C. bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of informetrics*. 2017;11(4):959–975. doi:10.1016/j.joi.2017.08.007.
30. Cheng T. Chemical evaluation of electronic cigarettes. *Tobacco control*. 2014;23(suppl 2):ii11–ii17. doi:10.1136/tobaccocontrol-2013-051482.