International Journal of Clinical Practice

WILEY

SPECIAL ISSUE Oral and Systemic Health – Implications for Clinical Practice

RESEARCH ARTICLE OPEN ACCESS

Oral–Systemic Health Interactions in Dentistry: A 25-Year Bibliometric and Thematic Mapping Analysis

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Received: 8 December 2025 | **Revised:** 24 June 2026 | **Accepted:** 14 July 2026

Guest Editor: Nikhat Kaura

Keywords: oral health | periodontitis | scientometric analysis | systemic disease

ABSTRACT

Aim: This study aimed to conduct a 25-year bibliometric and thematic mapping analysis to explore how the scientific literature linking oral health and systemic diseases has evolved, focusing on major trends, diagnostic developments, and emerging interdisciplinary directions.

Materials and Methods: Publications indexed in the Web of Science Core Collection (2000–October 2025) under "Dentistry and Oral Medicine" were analyzed using the Biblioshiny R package and VOSviewer. Annual scientific output, citation trends, contributing countries, journals, and keyword-based thematic structures were evaluated.

Results: A total of 2650 articles met the inclusion criteria. Global research output showed a steady increase, with a marked surge after 2015. The United States, China, Brazil, and England were the most productive countries, while several European nations demonstrated the highest citation impact. Periodontology journals dominated publication volume; however, recent years revealed diversification toward endodontic, peri-implant, and oral oncology topics. Thematic evolution maps indicated a transition from periodontal inflammation–oriented research themes to broader mechanistic perspectives.

Conclusions: Oral–systemic health research has shifted from a periodontally centered field to a broader interdisciplinary domain integrating molecular, microbiological, and translational approaches. While significant progress has been achieved, future studies should focus on underexplored areas such as endodontic pathology, surgical interventions, and orthodontic influences to achieve a comprehensive understanding of oral contributions to systemic health.

1 | Introduction

Oral health plays a fundamental role in general well-being and quality of life. Increasing scientific attention over the past 2 decades has emphasized that oral conditions extend beyond the oral cavity and exert meaningful effects on systemic health [1]. The oral cavity serves as a reservoir for pathogenic microorganisms, inflammatory mediators, and metabolic byproducts, enabling microbial dissemination and immune activation [2]. Recent work in microbiome and salivary biomarkers further supports the oral cavity as a contributor to systemic inflammation [3]. Among oral diseases, periodontitis, because of its high global prevalence and well-defined inflammatory and microbial pathways, has served as the primary model linking oral dysbiosis to systemic immune activation, endothelial dysfunction, and chronic disease burden [4]. Beyond periodontitis, other oral inflammatory and functional conditions—including endodontic infection [5], peri-implant inflammation, prosthodontic and functional impairments, orthodontic tooth-movement–related remodeling processes [6, 7], and surgically

induced tissue responses [8, 9]—also contribute to immune pathways, supporting the view that oral health represents an integral component of general health [2].

Interdisciplinary care, personalized medicine, and preventive health models increasingly incorporate oral health markers when assessing systemic disease risk and progression [1]. As the evidence base expands, the rapid growth of publications has made it increasingly challenging to discern overarching trends and the most influential contributions. Therefore, systematic evaluation and mapping of research activity are essential to clarify how knowledge has evolved, identify leading contributors, and highlight emerging scientific directions [10].

Bibliometric and scientometric analyses offer robust methods to examine scientific structure, publication productivity, intellectual influence, and thematic trends at scale. They allow visualization of collaboration networks, citation impact, and conceptual evolution, thereby identifying established research areas and highlighting novel or underexplored topics [11]. When combined with thematic mapping and keyword co-occurrence analyses, these approaches trace how scientific concepts progress from emerging topics to mainstream domains [12].

Despite increasing interest, no bibliometric study has provided an integrated, long-range overview of oral–systemic health research across major dental disciplines. Previous searches have focused on single systemic conditions or isolated dental specialties, resulting in fragmented insights into the broader landscape. By integrating quantitative bibliometrics with qualitative thematic interpretation, the present study offers a comprehensive synthesis, outlining how the field has developed and providing guidance for future directions.

2 | Materials and Methods

This bibliometric analysis was conducted following established guidelines for reporting bibliometric studies in biomedical research [13]. The study selection process was reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to enhance transparency and reproducibility of record identification and screening. As the study was based exclusively on publicly available published literature and did not involve human participants or patient data, neither ethics committee approval nor written informed consent was required.

2.1 | Data Source and Search Strategy

Data for this study were retrieved from the Web of Science Core Collection (WoSCC) on 27 October 2025, including indexes applicable to the field, namely, Science Citation Index Expanded (SCI-Expanded), Emerging Sources Citation Index (ESCI), Social Sciences Citation Index (SSCI), and Book Citation Index–Science (BKCI-S). The search query applied in the WoSCC was as follows: TS = (oral OR dental OR periodontal OR endodontic OR prosthodontic OR orthodontic OR maxillofacial) AND (systemic AND (health OR disease OR condition OR infection OR inflammation OR disorder)) AND (cardiovascular OR osteoporosis OR diabetes OR rheumatoid arthritis OR obesity OR radiotherapy OR endocarditis OR metabolic syndrome OR osteonecrosis OR pregnancy OR cancer OR malignancy OR renal disease OR hematologic disease OR autoimmune OR immunologic OR neurologic OR respiratory). The TS query intentionally captured a broad range of dental literature. The selection of search terms was performed through a structured, multistep process. Preliminary scoping searches were conducted to identify commonly used terminology in the field. These terms were then refined by examining keywords used in highly cited and representative publications related to oral–systemic health. The final set of keywords was selected to capture the core literature while excluding unrelated topics, thereby maintaining the thematic relevance of the dataset. To validate the search strategy, the results were first restricted to the Dentistry and Oral Medicine category. A random sample of 200 records was generated using Excel-based randomization and independently screened by two reviewers. This process demonstrated high interreviewer agreement ($\kappa = 0.85$) and a low proportion of irrelevant items (~5%–7%). Studies were considered "outside the citation data" if they met one of the following conditions: (i) focused exclusively on dental without any reference to systemic health outcomes or associations; (ii) focused solely on systemic diseases without addressing oral health conditions; or (iii) investigated highly specific technical, material, or procedural aspects of dental treatments without discussing their potential systemic implications. The screening process was performed in two stages (title/abstract and full-text screening). Disagreements were resolved through discussion and, when needed, by consulting a third reviewer. The selection process is summarized in the flow diagram given in Figure 1.

2.2 | Data Collection and Analysis

For each included article, the "full records and cited references" files were obtained from WoSCC in plain-text format for use in bibliometric software. Bibliometric analyses were conducted using *RStudio* (Posit Software, Boston, MA, USA) with the Biblioshiny web-interface package (Bibliometrix R package, Version 4.2.0; University of Naples Federico II, Naples, Italy) for data processing, global mapping, journal analysis, and thematic evaluation. Geographical distribution and citation performance of contributing countries were visualized using density maps, enabling comparative assessment of publication volume and average citations across regions. Journal distribution was evaluated by ranking sources according to the number of published documents, and a bubble chart was generated to display the volume across journals. The data, including total and average citations per document, were directly extracted from the WoSCC at the time of data retrieval using its built-in analysis tools. Specifically, total citation counts for each document were obtained, and the average citation per document was calculated by dividing the total number of citations by the total number of publications within the dataset. International collaboration patterns between countries were evaluated using Visualization of Similarities Viewer (VOSviewer). A minimum threshold of five publications per country was applied to ensure the inclusion of the most productive contributors. To improve data consistency, a thesaurus file was used to merge variations in country names (e.g., Türkiye and Turkey) under a single standardized term. The top 50 most-cited articles were identified based on total citation counts, and citation data from the previous five years were extracted to illustrate recent trends. A keyword co-occurrence analysis was conducted using VOSviewer software (Version 1.6.15; Center for Science and

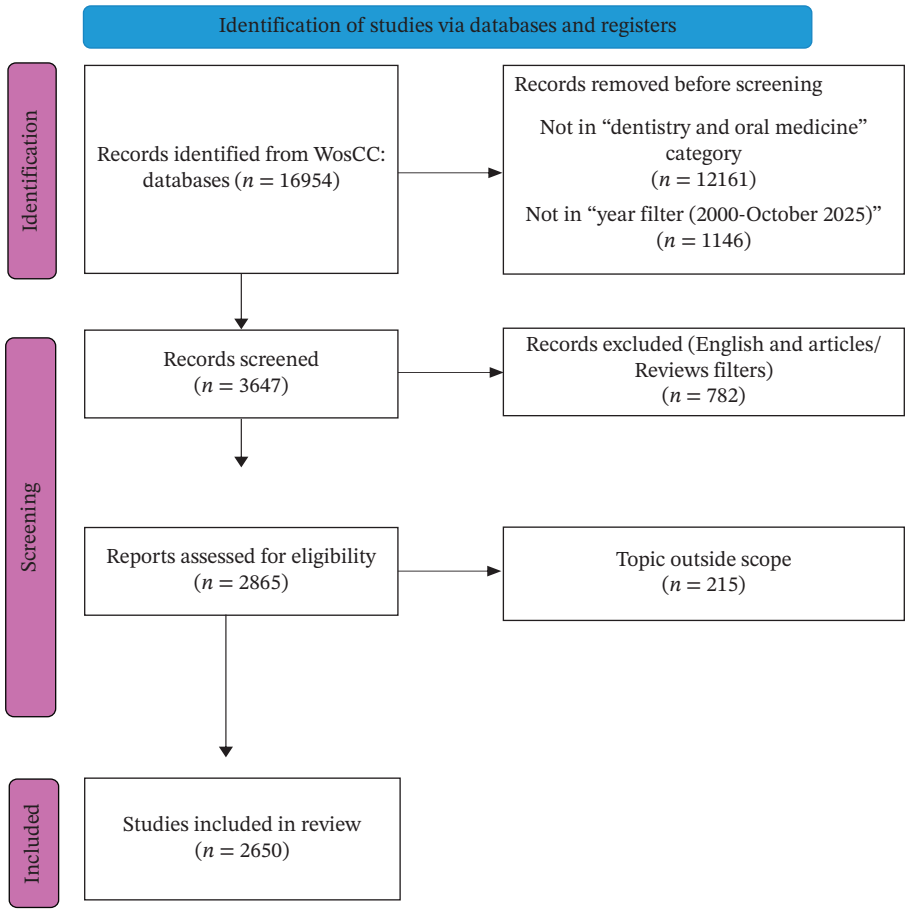


FIGURE 1 | Flow diagram of the study selection process.

Technology Studies, Leiden University, Leiden, Netherlands), applying a minimum keyword-occurrence threshold of 5 to construct the co-occurrence network. The thematic evolution mapping was performed using the text-analysis module in Biblioshiny, applying 250 terms, a minimum cluster frequency of 5 per thousand documents, Walktrap clustering, and

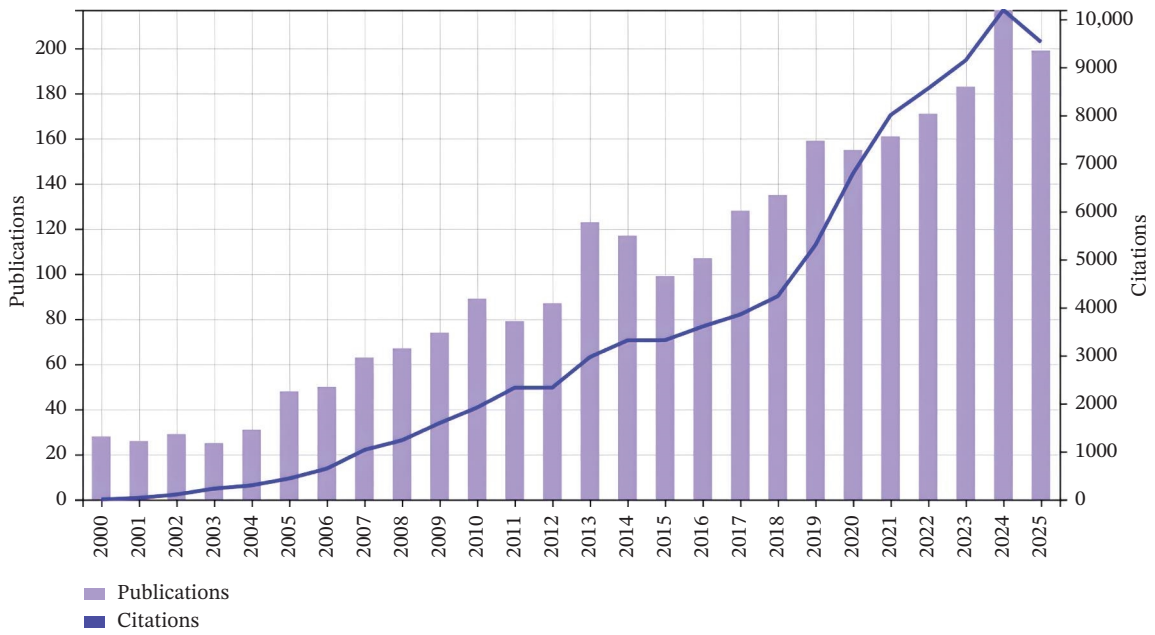
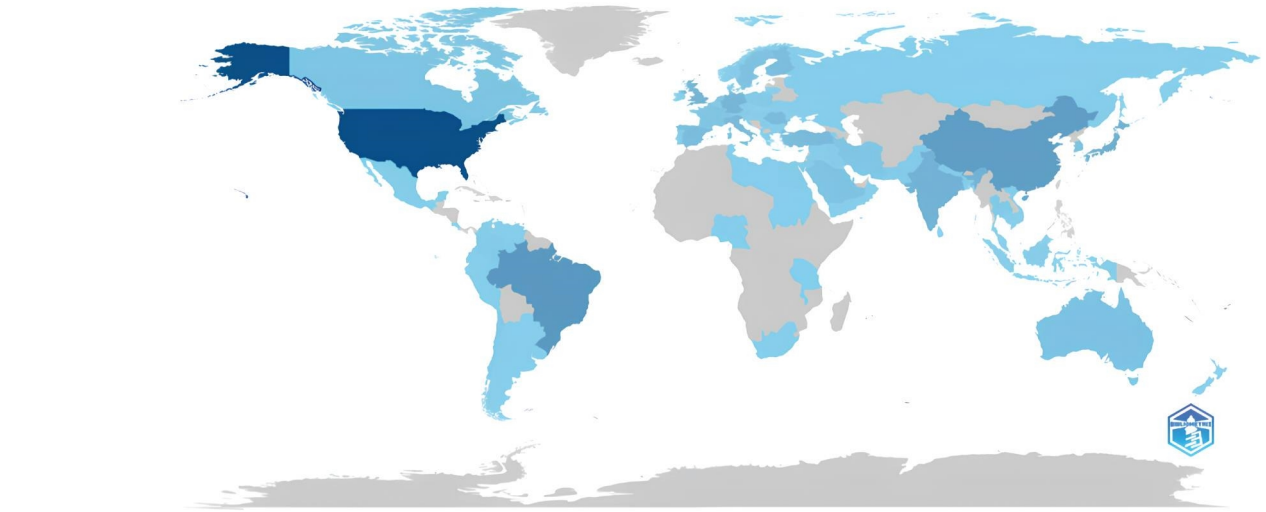
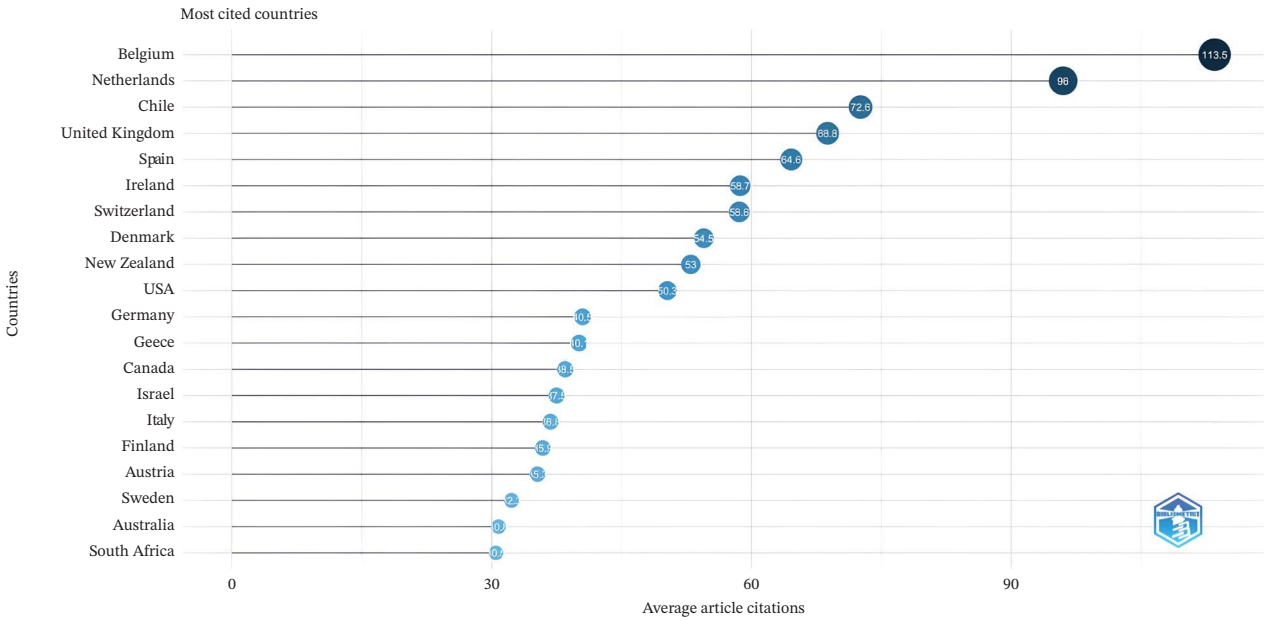


FIGURE 2 | Annual publication output and citations. The bars represent the annual number of publications, while the line indicates yearly citation frequency.



(A)



(B)

FIGURE 3 | Global scientific production and citation impact in the field. (A) Worldwide distribution of publications, with darker shades indicating higher research output. (B) Leading contributing countries based on average citations per article.

inclusion-index weighting. Label size and minimum weight thresholds were standardized across periods to ensure consistent thematic comparison.

3 | Results

Records retrieved from the WoSCC amounted to 16,954. After restricting results to the "Dentistry and Oral Medicine" category, 4793 records remained. Applying the publication year filter reduced the dataset to 3647 records, and subsequent language and document type filtering resulted in 2865 records. Title and abstract screening excluded 215 studies, leaving 2650 articles for final analysis.

Annual scientific output in this field demonstrated a consistent upward trajectory, particularly after 2015, accompanied by a marked increase in citation frequency, indicating growing academic interest and impact over time (Figure 2).

Global research output demonstrated wide geographic participation, with the highest publication volume originating from the United States, followed by China, Brazil, and England (Figure 3A). Countries with the highest publication volume also ranked high in total citations; however, average citation analysis revealed strong relative influence from several European countries, highlighting their strong citation performance (Figure 3B).

The country collaboration map (Figure 4) suggested that the United States occupied a central position within the international research network on oral–systemic health, forming the strongest partnerships with England, Brazil, and Germany. A dense intra-European collaborative cluster was also identified, involving

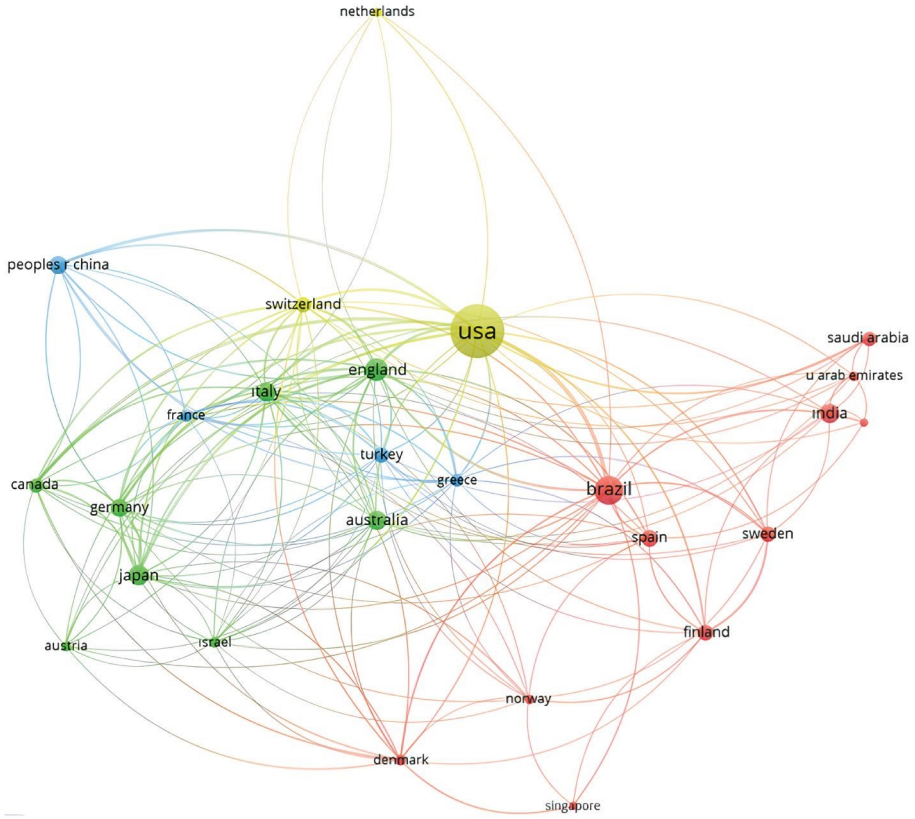


FIGURE 4 | Country collaboration map.

countries such as Sweden, Switzerland, and the Netherlands, indicating strong regional research integration. In contrast, despite its high publication output, China exhibited relatively limited international collaboration.

The most relevant sources were led by the *Journal of Periodontology* ($n = 258$), followed by the *Journal of Clinical Periodontology* ($n = 195$) and *Oral Diseases* ($n = 120$), indicating that periodontal and general oral health journals accounted for a substantial proportion of the literature (Figure 5). Analysis of the top 50 most-cited publications (Table 1) revealed a strong dominance of periodontal research within the literature. Highly cited articles were most frequently published in the *Journal of Clinical Periodontology*, *Periodontology 2000*, and the *Journal of*

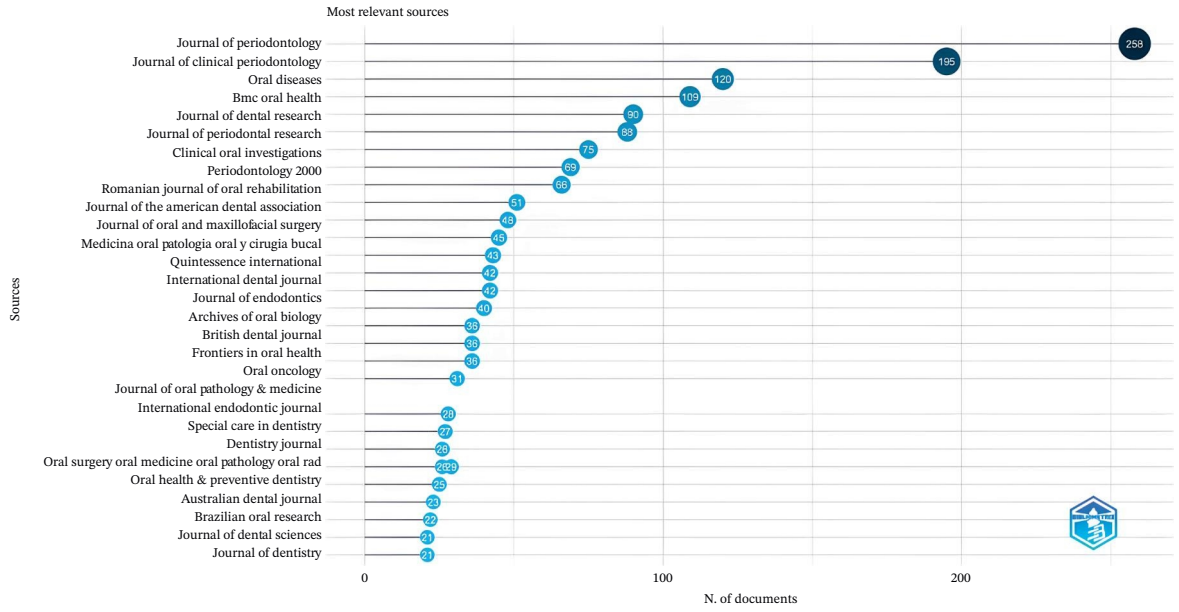


FIGURE 5 | Most relevant publication sources in the field. Journals are ranked by publication count, with bubble size indicating the number of articles from each source.

TABLE 1 | Top 50 most-cited articles with annual citation distribution.

Rank	Title	Authors	Journal	Publication year	Year				Citations October 2025	Average per year	Total
					2021	2022	2023	2024			
1	Periodontitis and cardiovascular diseases	Sanz M, del Castillo AM et al.	J Clin Periodontol	2020	138	188	85	267	228	177.83	1067
2	Risk factors for periodontal disease	Genco RJ, Borgnakke WS	Periodontology 2000	2013	72	85	52	91	86	65	845
3	Diabetes and periodontal diseases	Chapple ILC, Genco R	J Clin Periodontol	2013	61	54	28	71	54	49.08	638
4	Diabetes mellitus and periodontal diseases	Mealey BL, Oates TW	J Periodontol	2006	34	28	23	29	31	30.5	610
5	Elevation of systemic markers related to cardiovascular disease in the peripheral blood of periodontitis patients	Loos BG, Craandijk J et al.	J Periodontol	2000	25	25	42	17	10	23.08	600
6	Periodontitis and atherosclerotic cardiovascular disease	Tonetti MS, Van Dyke TE	J Clin Periodontol	2013	51	52	33	53	63	45.92	597
7	A systematic review and meta-analyses on C-reactive protein in relation to periodontitis	Paraskevas S, Huizinga JD, Loos BG	J Clin Periodontol	2008	39	31	91	30	26	31.33	564
8	Periodontal manifestations of systemic diseases and developmental and acquired conditions	Jepsen S, Caton JG et al.	J Clin Periodontol	2018	75	96	27	97	109	68.13	545
9	Periodontitis and systemic inflammation: control of the local infection is associated with a reduction in serum inflammatory markers	D'Aiuto F, Parkar M et al.	J Dent Res	2004	27	18	19	21	18	24.32	535
10	Periodontal infections contribute to elevated systemic C-reactive protein level	Noack B, Genco RJ et al.	J Periodontol	2001	17	15	29	9	8	19.68	492
11	Systemic markers of inflammation in periodontitis	Loos BG	J Periodontol	2005	30	31	73	29	21	23.05	484
12	Global burden of oral diseases: emerging concepts, management, and interplay with systemic health	Jin LJ, Lamster IB et al.	Oral Diseases	2016	64	57	88	63	53	47.7	477
13	The oral microbiome: role of key organisms and complex networks in oral health and disease	Sedghi L, DiMassa V et al.	Periodontology 2000	2021	2	67	16	147	127	86.6	433

(Continues)

TABLE 1 | (Continued)

Rank	Title	Authors	Journal	Publication year	Year				Citations October 2025	Average per year	Total
					2021	2022	2023	2024			
14	Changing paradigms in concepts on dental caries: consequences for oral health care	Fejerskov O	Caries Res	2004	26	26	74	19	12	18.95	417
15	Clinical and public health implications of periodontal and systemic diseases: an overview	Genco RJ, Sanz M	Periodontology 2000	2020	50	70	27	110	103	69.17	415
16	Periodontal disease and systemic conditions: a bidirectional relationship	Kim J, Amar S	J Odontol	2006	46	32	77	25	24	19.35	387
17	The role of inflammation and genetics in periodontal disease	Loos BG, Van Dyke TE	Periodontology 2000	2020	59	59	51	100	88	64.83	389
18	Interaction of lifestyle, behavior or systemic diseases with dental caries and periodontal diseases	Chapple ILC, Bouchard P et al.	J Clin Periodontol	2017	53	60	32	61	46	42.33	381
19	Mobile microbiome: oral bacteria in extra-oral infections and inflammation	Han YW, Wang X	J Dent Res	2013	47	53	25	24	25	28.62	372
20	Oral lichen planus and oral lichenoid lesions: diagnostic and therapeutic considerations	Al-Hashimi I, Schifter M et al.	Oral Surg Oral Med Oral Pathol Oral Radiol Endod	2007	26	23	28	22	18	19	361
21	Inflammatory mechanisms linking periodontal diseases to cardiovascular diseases	Schenkein HA, Loos BG	J Clin Periodontol	2013	39	28	84	27	22	27.77	361
22	Oral microbiota in human systematic diseases	Peng X, Cheng L et al.	Int J Oral Sci	2022	0	17	19	134	119	88.75	355
23	Immune response: the key to bone resorption in periodontal disease	Taubman MA, Valverde P et al.	J Periodontol	2005	24	6	72	16	8	16.9	355
24	Saliva in the diagnosis of diseases	Zhang CZ, Cheng XQ et al.	Int J Oral Sci	2016	42	45	39	51	56	35.3	353
25	Oral microbiome metabolism: from “who are they?” to “what are they doing?”	Takahashi N	J Dent Res	2015	45	44	24	39	47	31.91	351
26	Periodontal systemic associations: review of the evidence	Linden GJ, Lyons A, Scannapieco FA	J Clin Periodontol	2013	28	23	57	26	12	26.62	346

(Continues)

TABLE 1 | (Continued)

Rank	Title	Authors	Journal	Publication year	Year				Citations October 2025	Average per year	Total
					2021	2022	2023	2024			
27	Basic biology and role of interleukin-17 in immunity and inflammation	Zenobia C, Hajishengallis G	Periodontology 2000	2015	35	50	9	62	55	31.45	346
28	Acute-phase inflammatory response to periodontal disease in the us population	Slade GD, Offenbacher S et al.	J Dent Res	2000	5	8	11	2	9	12.23	318
29	Systemic effects of periodontitis: epidemiology of periodontal disease and cardiovascular disease	Beck JD, Offenbacher S	J Periodontol	2005	23	16	5	13	3	14.9	313
30	Offenbacher S	D'Aiuto F, Nibali L et al.	J Dent Res	2005	13	6	10	13	7	14.33	301
31	Short-term effects of intensive periodontal therapy on serum inflammatory markers and cholesterol	Ramseier CA, Kinney JS et al.	J Periodontol	2009	24	15	50	14	10	16.35	278
32	Identification of pathogen and host-response markers correlated with periodontal disease	Kitamoto S, Nagao-Kitamoto H et al.	J Dent Res	2020	27	42	8	82	67	45.5	273
33	The bacterial connection between the oral cavity and the gut diseases	Pischon N, Heng N et al.	J Dent Res	2007	15	13	65	9	5	14.37	273
34	Obesity, inflammation, and periodontal disease	Graves DT, Ding ZJ, Yang YM	Periodontology 2000	2020	29	45	49	68	51	45.5	273
35	The impact of diabetes on periodontal diseases	Graves DT, Corrêa JD, da Silva TA	J Dent Res	2019	52	43	44	43	49	38.71	271
36	The oral microbiota is modified by systemic diseases	Polak D, Shapira L	J Clin Periodontol	2018	27	46	15	49	36	33.88	271
37	An update on the evidence for pathogenic mechanisms that may link periodontitis and diabetes	Paju S, Scannapieco FA	Oral Diseases	2007	20	10	58	11	6	13.53	257
38	Oral biofilms, periodontitis, and pulmonary infections	Hajishengallis G	Periodontology 2000	2022	0	23	5	83	89	63.25	253
39	Interconnection of periodontal disease and comorbidities: evidence, mechanisms, and implications	Tezal M, Wactawski-Wende J et al.	J Periodontol	2000	7	9	29	2	7	9.69	252
40	The relationship between bone mineral density and periodontitis in postmenopausal women	Huang SH, O'Sullivan B	Med Oral Patol Oral Cir Bucal	2013	35	29	13	25	23	19.15	249

(Continues)

TABLE 1 | (Continued)

Rank	Title	Authors	Journal	Publication year	Year				Citations October 2025	Average per year	Total
					2021	2022	2023	2024			
41	Oral cancer: current role of radiotherapy and chemotherapy	Spielmann N, Wong DT	Oral Diseases	2011	31	15	49	9	13	15.93	239
42	Saliva: diagnostics and therapeutic perspectives	Kapila YL	Periodontology 2000	2021	3	41	9	78	66	47.4	237
43	Oral health's inextricable connection to systemic health: special populations bring to bear multimodal relationships and factors connecting periodontal disease to systemic diseases and conditions	Turner MD, Ship JA	J Am Dent Assoc	2007	17	18	45	17	10	12.16	231
44	Dry mouth and its effects on the oral health of elderly people	Yu B, Wang CY	Periodontology 2000	2007	0	16	39	83	86	57.5	230
45	Osteoporosis and periodontal diseases- an update on their association and mechanistic links	Preshaw PM, Bissett SM	Br Dent J	2019	33	42	6	56	40	32.43	229
46	Periodontitis and diabetes	Mustapha IZ, Debrey S et al.	J Periodontol	2007	12	13	36	7	6	12.05	229
47	Markers of systemic bacterial exposure in periodontal disease and cardiovascular disease risk: a systematic review and meta-analysis	Segura-Egea JJ, Martín-González J, Castellanos-Cosano L	Int Endod J	2015	22	30	3	34	32	20.73	228
48	Endodontic medicine: connections between apical periodontitis and systemic diseases	Wong, DT	J Am Dent Assoc	2006	6	1	2	2	4	11	220
49	Salivary diagnostics powered by nanotechnologies, proteomics and genomics	Mercado F, Marshall R et al.	J Clin Periodontol	2000	12	4	6	3	7	8.38	218
50	Is there a relationship between rheumatoid arthritis and periodontal disease?	Ramseier CA, Kinney JS et al.	J Clin Periodonto	2005	9	7	85	2	1	10.33	217

TABLE 2 | Most prolific authors in oral–systemic health research (authors with > 10 publications).

Author	Number of publications
Offenbacher S	23
D'Aiuto F	18
Scully C	18
Kocher T	17
Sanz M	16
Beck JD	15
Epstein JB	15
Genco RJ	15
Loos BG	14
Meurman JH	14
Papanou PN	14
Sorsa T	13
Yamazaki K	13
Bartold PM	12
Chapple ILC	12
Katz J	12
Persson GR	12
Fischer RG	11
Jin LJ	11
Pasarin L	11
Scannapieco FA	11

Periodontology, demonstrating clear journal-level centrality. Recent highly cited papers increasingly emphasize the oral microbiome, systemic inflammation, and broader oral–systemic health interactions, reflecting a growing shift toward more comprehensive and interdisciplinary perspectives. Author productivity was evaluated to identify the most prolific contributors in the field (Table 2). The authors with more than 10 publications were included. Offenbacher S was the most productive author, followed by D'Aiuto F. and Scully C.

The thematic evolution maps (Figure 6) reveal a progressive shift in research focus across the five periods. Between 2000 and 2004, studies primarily investigated links between periodontal inflammation, immune responses, and cardiovascular risk. From 2005 to 2009, topics expanded to include diabetes, bone metabolism, and inflammatory markers. During 2010–2014, the clusters were dominated by inflammation-related periodontal themes, with periodontitis, inflammation, and C-reactive protein forming the core motor cluster. Niche themes included bone-related topics such as dental implants and osseointegration. From 2015 to 2019, thematic areas expanded toward systemic disease classification, cardiovascular and inflammatory associations, and clinical risk factors such as smoking and pregnancy, while niche clusters addressed oral cancer, biofilm, lupus-related conditions, and bisphosphonate-associated osteonecrosis. In 2020–October 2025, the field was dominated by periodontitis–systemic disease associations as core basic themes, while emerging topics involved risk factors, cancer, and osteoporosis.

The keyword co-occurrence map revealed distinct thematic clusters, with periodontitis, systemic inflammation, cardiovascular disease, and metabolic conditions emerging as some of the most prominent themes in the literature. A total of 381 of 7821 keywords met the inclusion criteria and were included in the analysis (Figure 7). The map further emphasized the most dominant terms.

4 | Discussion

Over the past 25 years, research exploring the bidirectional relationship between oral health and systemic disease has expanded markedly, shifting from isolated specialty perspectives toward a more integrated medical–dental understanding. The consistent rise in publications and citations, particularly after 2015, coincides with increased attention to oral–systemic biological pathways, advances in microbiome research, and wider adoption of interdisciplinary healthcare frameworks [3, 14, 15]. The pronounced increase after 2015 likely reflects expanding recognition of oral health as a component of systemic disease prevention and management, along with advances in microbiome science, salivary diagnostics, and chronic disease epidemiology [16–18]. This growing body of evidence may also have practical implications for clinical care, encouraging dental practitioners to consider potential oral–systemic interactions during patient assessment and to collaborate more closely with medical colleagues when managing individuals with complex systemic conditions.

The peak in 2024, with approximately 200 publications, reflects the highest productivity to date, while the surge in citations reaching ~10,000 in the same year demonstrates not only increased volume but also substantial visibility and influence within the field. However, citation-based metrics are inherently time-dependent, and older publications tend to accumulate more citations over time; therefore, observed increases in citation counts should be interpreted with caution, as they may reflect temporal accumulation effects in addition to growing activity. The apparent decline observed in 2025 should not be interpreted as a reduction in research momentum. Instead, it is primarily explained by the incomplete calendar year and inherent citation lag, as newly published studies require time to accumulate citations [19]. Overall, the post-2015 trajectory suggests that the field has shifted from a peripheral topic to a mainstream scientific domain; however, research output remains concentrated in specific regions. The United States, Brazil, and China produced the highest publication volume, reflecting strong research infrastructure and sustained investment [20]. In contrast, European countries such as the Netherlands, Belgium, Switzerland, Sweden, and Denmark demonstrated the highest average citation impact, suggesting that factors beyond publication volume may contribute to scientific influence and citation performance. Meanwhile, participation from Latin America, Africa, and parts of Asia remains limited, highlighting ongoing global research disparities and the need for greater international collaboration and capacity-building. These imbalances may result from differences in research infrastructure, funding availability, and the integration of oral–systemic concepts into national health priorities [21].

The international collaboration network not only illustrates connections between countries but also indirectly reflects the relationship between research productivity and scientific impact [22]. The United States, which has the highest publication output, may illustrate a potential association between research

FIGURE 6 | Thematic evolution structure of research topics across periods: (A) 2000–2004, (B) 2005–2009, (C) 2010–2014, (D) 2015–2019, and (E) 2020–October 2025. This visual synthesis demonstrates the transition of key research themes over time, highlighting shifts from niche and emerging topics toward core motor themes.

productivity and international collaboration. Countries with higher output tend to be more integrated into broader networks, which may accelerate knowledge exchange and enhance their visibility and citation potential [23]. However, this relationship is not strictly proportional across countries, as some high-output countries exhibit limited international partnerships, while others achieve greater impact through stronger network integration [22]. For instance, despite its high productivity, China demonstrates relatively limited international collaboration links, which may partly explain its citation profile relative to its publication output. In contrast, some European countries achieve higher citation impact despite lower publication volumes, likely due to their stronger integration into global networks [24].

The journal distribution highlights that the *Journal of Periodontology* and the *Journal of Clinical Periodontology* accounted for the largest share of publications, reflecting a strong focus on periodontal inflammation, systemic immune responses, and cardiometabolic associations [25–27]. However, oral–systemic health research did not originate solely from periodontal science. Early contributions also came from endodontics [28], oral oncology [29], and oral medicine [30], demonstrating parallel interest across multiple dental disciplines. Consequently,

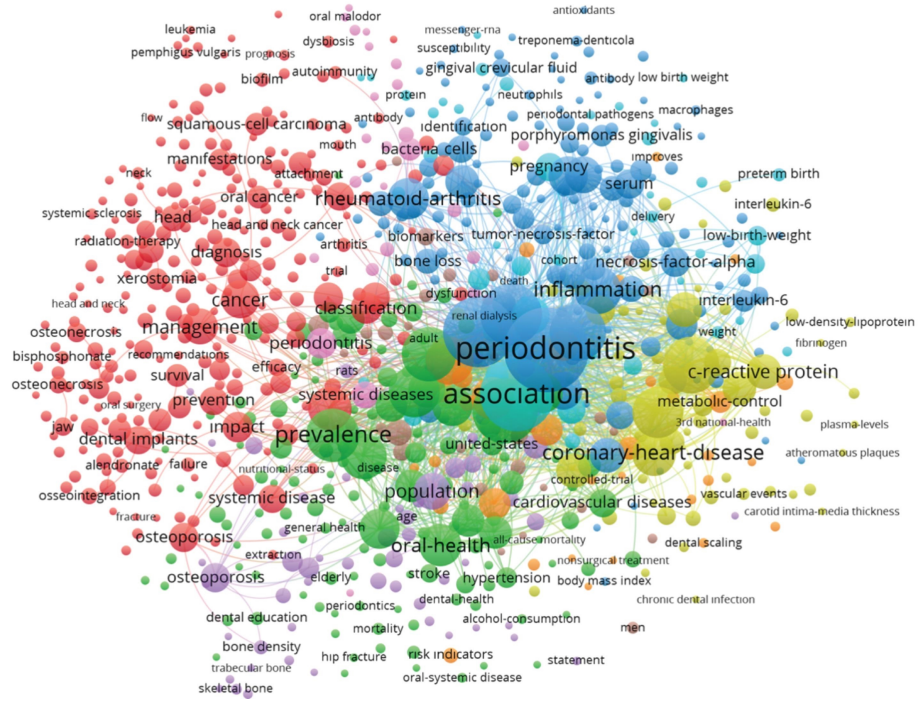


FIGURE 7 | Keyword co-occurrence network map. The visualization illustrates major thematic clusters in the literature. Cluster colors represent distinct research domains, highlighting interconnected themes spanning across the field.

contributions from other dental specialties became increasingly visible over time [25, 30]. The subsequent prominence of journals such as *Clinical Oral Investigations* and *Oral Diseases* illustrates a shift toward multidisciplinary and translational perspectives. These trends are also reflected in the patterns observed among the top-cited publications. Author productivity analysis further showed that a relatively small group of researchers contributed a notable proportion of publications, indicating the presence of leading contributors shaping the field.

Over time, the thematic maps indicate diversification of research themes beyond inflammation-focused hypotheses. Early studies emphasized the link between periodontitis-related inflammation and systemic outcomes, particularly cardiovascular and metabolic effects. Subsequent work explored immune pathways, oxidative stress, and bone metabolism. Between 2015 and 2019, biological mechanisms and salivary biomarkers became more prominent, likely supported by advances in diagnostic technologies that improved detection and analysis [3, 31]. Recently, attention has extended to the oral microbiome, metabolic regulation, cancer-associated pathways, and peri-implant conditions. This trajectory aligns with the keyword co-occurrence map, which shows inflammation-related concepts at the core of the network and demonstrates a gradual inclusion of microbiome, metabolic, oncology, and endodontic terms within expanding thematic clusters.

In our dataset, endodontic topics constituted a relatively small but distinct microcluster within the broader research field. Most studies focused on apical periodontitis and its relationship with systemic health [32, 33], including a recent bibliometric analysis of the 100 most-cited papers in this area [34], in which coronary heart disease and diabetes mellitus emerged as the dominant systemic outcomes. These investigations predominantly examine apical periodontitis in relation to general markers of inflammation [35, 36], while several clinically relevant areas remain insufficiently investigated. Research addressing endodontic disease within the context of metabolic syndrome, autoimmune disorders, and metabolic conditions exists [37–39] but remains largely unexplored, offering limited mechanistic insight. In addition, endodontic–systemic interactions in oncology-related settings—such as cancer therapy, radiotherapy-induced tissue alterations, or the impact of antiresorptive medications—are rarely investigated, representing important areas for future research.

From a clinical perspective, the findings of this bibliometric analysis emphasize the growing recognition of oral health as an integral component of systemic health. Increased awareness of oral–systemic interactions may encourage clinicians to incorporate relevant medical history, systemic risk factors, and interdisciplinary communication into routine patient care. Furthermore, the identification of underexplored research areas may help guide future clinical investigations and contribute to the development of more comprehensive evidence-based approaches for patient management [8]. Although periodontal conditions dominate the current literature, this analysis also reveals the relative underrepresentation of endodontic, surgical, and orthodontic topics. Expanding research in these areas may contribute to a better understanding of potential oral–systemic relationships and help inform future patient care strategies.

In this study, data were sourced from the WoSCC, selected for its high-quality indexing of peer-reviewed journals and strong compatibility with bibliometric software [40]. However, reliance on a single database may have led to the exclusion of relevant studies from other platforms. In addition, differences in indexing policies across databases may have influenced the representation of certain disciplines and research areas within the dataset. Self-citations were not specifically evaluated, which may have a minor influence on the interpretation of citation patterns. The use

of broad search terms, while enabling a general mapping of the field, may have limited the inclusion of highly specialized subtopics and specific systemic conditions, potentially influencing the representation of certain disciplines. In addition, differences in scientific visibility and awareness across dental disciplines may further contribute to this imbalance, as periodontology has historically attracted greater attention due to well-established systemic links, whereas endodontic associations may be less recognized, potentially affecting both publication output and citation patterns. Although the past 25 years of oral–systemic research have predominantly focused on periodontal inflammation and its cardiometabolic implications, the oral cavity includes multiple disease processes with systemic influence that remain comparatively under-investigated [41]. Endodontic pathologies can generate persistent low-grade inflammation, bacteremia, and immune activation [42], yet mechanistic evidence linking apical periodontitis to systemic outcomes remains limited. Similarly, surgical interventions in the maxillofacial region, peri-implant inflammatory conditions, and orthodontic tooth movement can alter immune responses and metabolic pathways [43–45], suggesting that the systemic footprint of oral care extends beyond periodontal disease alone. Addressing these gaps will require mechanistic and longitudinal studies examining how pulpal infection, bone healing biology, biomaterial–host interactions, and treatment-induced immune modulation contribute to systemic status. Integrating future evidence from these areas into clinical practice may contribute to improved risk assessment, early diagnosis, and personalized treatment strategies for patients with systemic comorbidities.

5 | Conclusions

The systemic implications of oral health highlight its essential contribution to understanding the broader landscape of general health. This 25-year bibliometric analysis identifies a shift from periodontal inflammation and cardiometabolic risk toward wider domains such as the microbiome, metabolic regulation, inflammatory pathways, and oral oncology. Expanding investigations across a wider range of dental specialties may help provide a more comprehensive understanding of the potential systemic implications of oral conditions.

Author Contributions

All authors contributed to the study conception and design. Substantial contributions to the conception and design of the study were made by Özge Başar and Edanur Maraş. The first draft of the manuscript was written by Özge Başar, and critical review with important intellectual contribution was provided by Özge Başar and Edanur Maraş.

Acknowledgments

This study has been supported by the Recep Tayyip Erdoğan University Development Foundation (Grant no. 02026003030212).

Funding

The authors received no financial support or funding for this study.

Disclosure

All authors have approved the final manuscript and agreed to take responsibility for all aspects of the work.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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