Journal of Orofacial and Health Sciences 2025;12(1):58–65

Content available at: https://www.ipinnovative.com/open-access-journals

DJ COLLEGE OF DENTAL SCIENCES & RESEARCH

Journal of Orofacial and Health Sciences
Journal homepage: www.johs.in

INNOVATIVE PUBLICATION

**Original Research Article**

# Dentistry-related COVID-19 documents published in scientific journals: A bibliometric analysis using Vosviewer

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## Abstract

**Background:** Novel coronavirus disease 19 (COVID-19) is being spread by the severe acute respiratory syndrome coronavirus (SARS-CoV-2) and had a huge impact on millions of people globally. Numerous articles related to COVID-19 and its impact on dental practice have been published in different scientific journals in several languages.

**Objective:** The aim is to conduct a descriptive bibliometric study of the main trends in dental research related to COVID-19, focusing on identifying the most productive journals, authors, institutions, and countries.

**Materials and Methods:** The global literature about COVID-19 published between January 2020 and December 2022 was scanned using the Web of Science database. For the visualized study, bibliographic coupling analysis, co-authorship analysis, co-citation analysis, co-occurrence analysis and the analysis of publication trends were conducted by software tool, VOS viewer.

**Results:** A total of 810 dentistry related to COVID-19 documents were identified, among which 480 (59.2%) were original articles, 137 (16.9%) review articles, 101 (12.5%) were editorials and 92 (11.4%) were letters to editors. The top three journals were the British Dental Journal, the International Journal of Environmental Research and Public Health, and the Journal of Dental Education, which accounted for 14.1% of all indexed literature. The USA (n=175, 21.6%) contributed the most to the research followed by Italy (n=114, 14.1%), the UK (n=92, 11.4%), China (n=74, 9.1%), and India (n=61, 7.5%).

**Conclusion:** Using bibliometric analysis to identify scientific production is essential so that researchers can identify what has already been produced and is currently being researched thereby addressing knowledge gaps in the future.

**Clinical Relevance**: A better understanding of existing research trends and potential research areas can be gained from this analysis. Such insights can help inform policy formulation, resource allocation, and evidence-based decision-making.

**Keywords:** COVID-19, SARS-CoV-2, Coronavirus, Bibliometrics, Dentistry

**Received:** 10-09-2024; **Accepted:** 14-10-2024; **Available Online**:



## 1. Introduction

Novel coronavirus disease 19 (COVID-19) is being spread by the severe acute respiratory syndrome coronavirus (SARS-CoV-2) and is directly and indirectly harming millions of people globally.[1] COVID-19 has been well-recognized for its grave health, socioeconomic, and environmental consequences across all social strata, especially the elderly with comorbid diseases, homeless individuals, and others who have financial, mental and physical hardships.[2,3] Amid this chaos, the scientific community has been active in publishing articles investigating various aspects of the disease, including epidemiological features, effective treatment options, signs and symptoms, and how it has affected different operations and communities.[4,5,6,7,8,9,10]

Dental journals are regarded as an important source of information on the dentistry-related implications of COVID-19 and SARS-CoV-.[2.7,9,11] Numerous articles related to COVID-19 and SARS-CoV-2 have been published in different scientific medical and dental journals, giving rise to a unique

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DOI: 10.18231/j.johs.2025.010

infodemic.[12,13] Recent years have seen a substantial increase in dentistry-related COVID-19 Documents (DCDs), including articles, reviews, letters to editors, and preprints.[6,7,12,14,15] Materials and Methods

*2.1 Data collection*

The articles studied in this analysis were extracted from the Web of Science (WOS) database (https://clarivate.com/webofsciencegroup), by Clarivate Analytics. In addition to the Core Collection publications, the WOS database includes articles from MEDLINE, BIOSIS Citation Index and previews, SciELO Citation Index, KCI Korean Journal Database, Russian Science Citation Index, and Current Contents Connect. There was no involvement of human subjects in this study, so institutional review board approval or informed consent was not needed.

The publications were searched using the following search keywords: (TS=COVID-19 OR 2019-nCoV OR coronavirus 2019 OR Coronavirus disease 2019 OR SARS-CoV-2) AND (SU=Dental OR dentistry OR oral health). The selection process did not include preprint databases like bioRxiv, arXiv, or medRxiv since such databases do not undergo the peer-review process, which may hamper their quality. To avoid bias caused by frequent database renewal, all the literature retrieval and data download were completed on March 1, 2023.

*2.1 Inclusion and exclusion criteria*

The inclusion criteria consisted of publications Web of science core collection, published in English, and published between 1st January 2020 and 31st December 2022. The following document types were excluded: duplicate publications, abstract, correction, clinical trial protocols, news patent, biography, conference papers, and unspecified or meeting, publications with no information on the author's name or affiliation or the article's digital object identifier.

*2.2 Parameters studied*

After a review of titles and abstracts, and ascertaining the accessibility of citation and cited references, the following parameters were extracted and analyzed: citation information – author(s), document title, year, source title, volume, issue,pages, citation count, source and document type, bibliographical information, affiliations,editor(s), keywords and funding details (number, acronym, sponsors). Based on the impact factor rankings from the 2019 Journal Citation Reports, all journals that were retrieved were divided into four groups, each belonging to a quartile: Q1, Q2, Q3, and Q4. The search strategy and the data collection process is explained in **Figure 1**.

*2.3 Data analysis and Visualization*

VOSviewer 1.6.11 (Leiden University, Leiden, Netherlands) is a software tool for the visualized analysis of the publications, which was used to extract the journals, authors, countries, and institutions/organizations of included studies and bibliographic coupling, co-authorship, co-citation, and co-occurrence analysis.[16,17,18] Journal were ranked based on SCImago Journal & Country Rank which is a publicly available portal.[19] The latest data on GDP (nominal) and income classifications were collected from the World Bank database.[20]

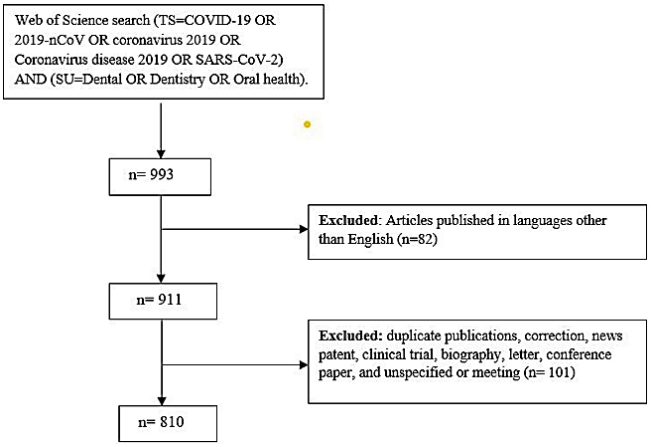


Figure 1:

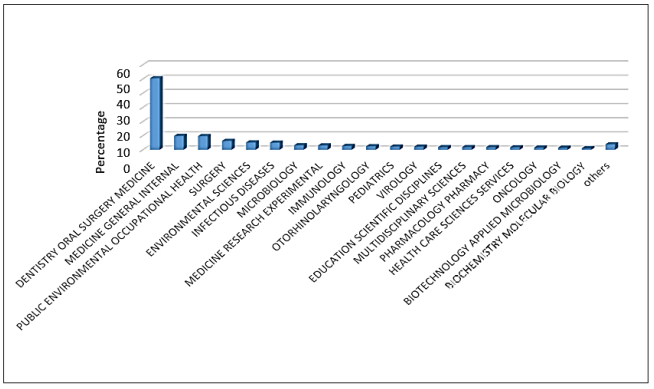


Figure 2:

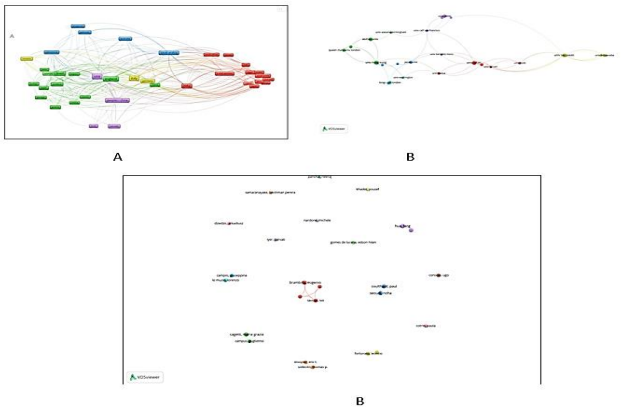


**Figure 3:** Bibliographic coupling analysis showing global research on COVID-19 and dentistry. (A) Mapping of the 41

countries who published 5 or more DCDs. (C) Mapping of 25 authors who published 4 or more documents.

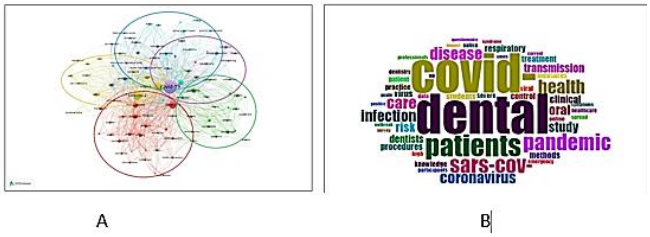


**Figure 4: (A)** Co-occurrence of keywords. Network visualization and analysis of keywords in the abstracts were performed, out of 1759 words 59 were selected and grouped into six clusters. **(B)** Word cloud. Tag clouds of words appearing in the abstracts of 810 DCDs. The font size represents the frequency of occurrence.

**Table 1:** The top 10 countries that published most DCDs

| Rank | Country | Number of documents (%) | Number of citations | Average citations per document | Country's GDP (Nominal)* | Number of International collaborations | Total link strength |
|---|---|---|---|---|---|---|---|
| 1 | USA | 175 (21.6) | 2450 | 14 | 1 | 35 | 126 |
| 2 | Italy | 114 (14.1) | 977 | 8.6 | 8 | 33 | 114 |
| 3 | UK | 92 (11.4) | 537 | 5.8 | 5 | 35 | 123 |
| 4 | China | 74 (9.1) | 2530 | 34.2 | 2 | 21 | 56 |
| 5 | India | 61 (7.5) | 346 | 5.7 | 6 | 29 | 75 |
| 6 | Saudi Arabia | 56 (6.9) | 286 | 5.1 | 19 | 27 | 83 |
| 7 | Brazil | 55 (6.8) | 283 | 5.1 | 13 | 24 | 56 |
| 8 | Canada | 31 (3.8) | 306 | 9.9 | 9 | 7 | 16 |
| 9 | Germany | 26 (3.2) | 343 | 13.2 | 4 | 28 | 87 |
| 10 | Pakistan | 24 (2.9) | 177 | 7.4 | 46 | 6 | 16 |

**Table 2:** The top 10 most active journals that published DCDs

| Rank | Journal title | Publisher | WOS research category | Number of documents (%) | Number of citations | h- index 2019 | Impact factor2019 | Quartile in category 2018 | SJR 2019 | Total link strength |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | British Dental Journal | Springer Nature, UK | Dentistry, Oral Surgery & Medicine | 38 (4.69) | 181 | 77 | 1.306 | Q2 | 0.41 | 4855 |
| 2 | International Journal of Environmenta Research and Public Health | MDPI, Switzerlan | Environmental Sciences; Public, Environmental & Occupational Health | 38 (4.69) | 501 | 92 | 2.849 | Q2 | 0.74 | 14200 |
| 3 | Journal of Dental Education | Wiley, USA | Dentistry, Oral Surgery & Medicine | 35 (4.32) | 143 | 66 | 1.322 | Q2 | 0.44 | 3538 |
| 4 | Oral Disease | Wiley, USA | Dentistry, Oral Surgery & Medicine | 27 (3.33) | 108 | 83 | 2.613 | Q1 | 0.78 | 8440 |
| 5 | Head and Neck | Wiley, USA | Otorhinolaryngol-ogy; Surgery | 18 (2.22) | 253 | 120 | 2.538 | Q1 | 1.16 | 2266 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | British Journal of Oral & Maxillofacial Surgery | Churchill Livingston, UK | Dentistry, Oral Surgery & Medicine | 17 (2.10) | 47 | 70 | 1.061 | Q2 | 0.53 | 1174 |
| 7 | Journal Of oral And Maxillofacial Surgery | WB Saunders Co-Elsevier Inc, USA | Dentistry, Oral Surgery & Medicine | 13(1.60) | 45 | 116 | 1.642 | Q2 | 0.74 | 2195 |
| 8 | BMC oral Health | Springer Nature, UK | Dentistry, OralSurgery & Medicine | 12(1.48) | 23 | 45 | 1.911 | Q1 | 0.73 | 5149 |
| 9 | Oral Oncology | Elsevier, Netherlands | Oncology;Dentistry, OralSurgery & Medicine | 12 (1.48) | 97 | 108 | 4.273 | Q1 | 1.74 | 1586 |
| 10 | European Journal of Dental Education | Wiley, USA | Dentistry, Oral Surgery & Medicine; Education, Scientific Disciplines | 11 (1.36) | 49 | 38 | 1.423 | Q2 | 0.38 | 2513 |

**Table 3:** Top 10 most cited articles in the research domain of dentistry and COVID-19.

| Sl. no | Journal name | Article | Authors | Impact factor (2019-2020) | Rank (of 91) in category (2022) | Quartile in category (2018) | Number of citations |
|---|---|---|---|---|---|---|---|
| 1 | International Journal of Oral Science | Transmission routes of 2019-nCoV and controls in dental practice | Peng et al. | 3.047 | 12 | Q1 | 491 |
| 2 | Journal of Dental Research | Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine | Meng et al. | 4.914 | 3 | Q1 | 385 |
| 3 | Journal of Endodontics | Coronavirus Disease 19 (COVID-19):Implications for Clinical Dental Care | Amber A et al. | 3.118 | 11 | Q1 | 143 |
| 4 | Clinical Oral Investigations | Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis | Sabino-Silva et al. | 2.812 | 15 | Q1 | 127 |
| 5 | British Dental Journal | Dentistry and coronavirus (COVID-19)-moral decision-making | Coulthard P | 1.306 | 72 | Q4 | 86 |
| 6 | Journal of Dental Research | COVID-19 Transmission in Dental Practice: Brief Review of Preventive Measures in Italy | Izzetti et al. | 4.914 | 3 | Q1 | 76 |
| 7 | Journal of Dental Research | The impact of the COVID-19 epidemic on the utilization of emergency dental services | Guo et al. | 1.034 | 83 | Q4 | 57 |
| 8 | Journal of Dental Education | Impact of COVID-19 on dental education in the United States | Iyer et al. | 1.322 | 71 | Q4 | 53 |
| 9 | International Journal of Oral Science | Saliva: potential diagnostic value and transmission of 2019-nCoV | Xu et al. | 3.047 | 12 | Q1 | 43 |
| 10 | Saudi Dental Journal | Guidelines for dental care provision during the COVID-19pandemic | Alharbi et al | 1.500 | NA | Q2 | 37 |

*3.2 Journals publishing research*

The top 10 journals have published 196 (24.4%) documents of all 810 DCDs (**Table 2**). Among them the top three journals were the *British Dental Journal*, the *International Journal of Environmental Research and Public Health*, and the *Journal of Dental Education*, which accounted for 14.1% of all indexed literature. DCDs published in the *International Journal of Environmental Research and Public Health* (n=501) received the most citations, followed by the *Head and Neck* (n=253) and the *British Dental Journal* (n=181). The highest Impact Factor belongs to the *Oral Oncology (4.273)*, followed by the

*International Journal of Environmental Research and Public Health (2.849)* and the *Oral Diseases (2.613).* Based on the SJR (2019), the highest-ranking journals were Oral Oncology (1.74), and Head & Neck (1.16).

*3.2 Bibliographic coupling analysis*

The top 5 countries based on a minimum number of publications of a country more than 5 were shown in figure 3 (A) and includes the USA (n=126 times), the UK (n=123 times), Italy (n=114 times), Germany (n=87 times) and Saudi Arabia (n=83 times). There were 53 institutions that produced 5 or more DCDs which is shown infigure 3 (B). The top 5 universities showed in terms of Total Link Strength (TLS) include *Hong Kong University* with 18 documents (TLS=19 times), the *University of Sao Paulo* with 18 documents (TLS=19 times), the University of Milan with 18 documents and (TLS=18 times), the *Queen Mary University London* 12 documents and 449 citations (TLS=18 times) and the *Mohammed Bin Rashid University of Medical and Health Science* 5 documents (TLS=18 times).

*3.3 Co-authorship analysis*

Among the 4051 researchers who contributed to 810 DCDs, 3696 researchers published one document, 288 researchers published two documents, 42 researchers published three documents, and 19 researchers published four documents. Paul Coulthard, Danchen Qin, Noha Seoudi, Eugenio Brambila, Fang Hua and Maria Cagetti are the researchers who have published five DCDs. When the network map was plotted with frequency greater than 4 documents, it had 25 researchers forming 16 clusters (**Figure 4** A).

*3.4 Quality of publication from different publications*

Using the WOS database analysis, total citations, average citation, and h-index were calculated. The overall h-index was 37 and The average citations per document was 9.24. Among 810 DCDs, the sum of times cited was found to be 7501, among which 5615 were without self-citations. Out of 4387 articles that were cited through DCDs, 1168 were from the USA, 537 were from Italy, 525 were from China, 386 were from the UK, and 384 were from India.

*3.5 Institutions*

Among the institutions with the highest number of DCDs published, the *University of London* is top of the list with 33 documents, followed by the *University of Hong Kong*, the *University of Milan*, and the *University of Sao Paulo*, each with 18 documents (**Table 3**). However, the University of Hong Kong had received the greatest number of citations (n=741) citations for dentistry-related COVID-19 documents, followed by the Wuhan University and the University of London with 449 and 227 citations, respectively. The top 10 institutions affiliated with the retrieved DCDs are listed in **Table 3**.

3.5 *Country*

Each country in this network is illustrated with different colours, standing for the number of average citations per document that has been received by them. The highestaverage citations per document regardless of the number of publications and collaborations belonged to China (n=34.2), the USA (n=14), Germany (n=13.2) and Spain (n=12.4).

*3.6 Analysis of themes and trend topics*

Analysis of 810 DCDs yielded 1759 keywords that were analyzed by VOSviewer (**Figure 4** A). With respect to different clusters, the following keywords occurred often: Cluster 1, COVID-19 (386 times), pandemic (45 times), dental education (41 times), and anxiety (29 times); Cluster 2, transmission (62 times), aerosols (47 times), and efficacy (29 times); Cluster 3, infection control (55 times), prevention (23 times), and virus (21 times); Cluster 4, infection (54 times), saliva (28 times), and outbreak (24 times); Cluster 5, dentist (26), knowledge (25 times) and awareness (12 times); Cluster 6, pneumonia (30 times), Wuhan (14 times), and China (12 times).

Red Cluster 2 [transmission (62 times), aerosols (47 times), and efficacy (29 times)] discussed the next topic of urgent discussion among the fraternity, which concerned how to prevent the spread of the virus in dental settings and the role of aerosol-generating procedures. The papers in Blue Cluster 3 [infection control (55 times), prevention (23 times), and virus (21 times)] discussed infection prevention guidelines and protocols from different agencies. It was followed by Yellow Cluster 4 [infection (54 times), saliva (28 times), and outbreak (24 times)] exploring the potential role saliva has in promoting infection transmission. Despite being less frequent than earlier clusters, this cluster was of particular importance because it examined a previously unexplored aspect of the disease.

In figure 4A, 59 keywords that appeared mor than 10 times were included and were grouped into 6 clusters in the map, each cluster forming a theme/topic. Each cluster stands for a theme. Theme (green)is the about the impact of OVID-19 on dental education and the anxiety it is creating among dental students; Theme 2 red) is about the prevention of transmission of the virus in a dental setting and the role of aerosol generating procedures; Theme 3 (blue) is about the infection prevention guidelines and protocols from different agencies; Theme 4 (yellow) deals with role of saliva in COVID-19 outbreak; Theme 5 (purple) is about awareness and knowledge of dentists about COVID-19; Theme 6 (aqua) highlights the origin of COVID-19. Figure 4B shows tag clouds of words appearing in the abstracts of 810 DCDs, were font size stands for the frequency of occurrence. Among the words that occur most often in the abstract, dental, COVID-19, patients, pandemic, and infection appear the most often.

## 2. Discussion

Controlling the spread of COVID-19, establishing proper safety protocols for the institution, and managing the disease itself have been the most urgent tasks for medical and scientific communities.[21] In many dental journals, topics such as salivary diagnostics, COVID-19 manifestations in the oral cavity and dental aerosol procedures and their considerations in COVID-19 transmission have been published.[9,12,13,19] However, our objective was to perform a comprehensive bibliometric analysis primarily on the research output of dental journals on COVID-19.

According to the dataset, 175 articles were published in the USA, accounting for over 21% of all research published worldwide, per earlier bibliometric analyses.[15,17,19,21,22,22,23] Because this analysis only included journals published in English, this could explain the difference. This suggests that the research was conducted in a Western-centric academic setting and may not reflect the actual global distribution of research.

In the analysis of the highest number of citations per document, China topped the list, followed by the USA, Germany and Spain. It is possible that the high number of citations from China is a result of clinical research published from this region since this area was the first global hotspot and early investigations happened there. This information has been instrumental in developing effective prevention and treatment strategies for the virus in China and elsewhere.[23,24]

A total of 341 international collaborations were recorded, with the strongest collaborations occurring in a cluster involving the USA, China, Canada, and Israel. There were 35 countries taking part in international collaborations, with the United States and United Kingdom collaborating with the most. In addition to enhancing our understanding of COVID-19's impact on dental practice, these collaborations have also contributed to developing effective prevention strategies.

There were 53 institutions that published at least five publications when co-authorship coupling, and analysis were conducted. The University of London had 33 documents, followed by Hong Kong University, Sao Paulo University, and Milan University, each with 18. With 297.8 deaths per 100,000 population, the UK has the highest rate of Coronavirus deaths in Western Europe.[3] This is even though the country has one of the most advanced healthcare systems in the world and one of the best performing countries in the world.

The most citations were found at the University of Hong Kong and Wuhan University as the initial outbreak made these two cities among the first global hotspots for SARS-CoV2. This shows that these universities were at the forefront of the research and response to the pandemic in its preliminary stages. As a result of the undivided attention of research groups to a single topic, these citations accumulated rapidly over a brief period.[25]

The number of articles in the study was large enough to analyze the knowledge trend in dentistry and COVID-19, but there are also some limitations. Even though the analysis of English-language journals is significant since they are more compatible with international information exchange, many articles published in other languages were not included. It is now necessary to conduct more comprehensive bibliometric analyses of dental journals in all languages in the future.

## 3. Conclusion

A comprehensive analysis of COVID-19 research output and contributions is presented in this study. This data can also be used to benchmark progress in research and foster collaboration across international boundaries. It can also provide a platform for researchers to share them ideas and collaborate on projects. This study suggests that the increased international cooperation among researchers during the pandemic led to a better quality of evidence and research regarding COVID-19, which may have made it easier for dentists to implement prevention and control measures.

## 4. Source of Funding

None.

## 5. Conflict of Interest

None.

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**How to cite:** Krishnaraaj S, Jayakumar N, Kiran B, Orafi M, Subhashraj V / Journal of Orofacial and Health Sciences 2025;12(1):58–65.