Bibliometric Analysis About Digital Dentistry

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Abstract:

The aim of this study is to examine research in digital dentistry through the bibliometric analysis of 2,117 publications between the years 2013 and 2022, extracted from the SCOPUS database. In particular, it seeks to highlight the collaborations between authors, universities and countries in the context, in order to identify the countries, universities, authors, and articles with the greatest impact and influence in this context. According to the results obtained, the United States and India are the most prolific countries in terms of publications on digital dentistry, with 373 and 322 publications, respectively. Regarding the most influential authors, Joda stands out, with 21

publications, while the most prominent university are Saveetha Dental College and Hospitals, and Saveetha Institute of Medical and Technical Sciences. The results of the analysis also show a low collaboration between authors, universities and countries that work in digital dentistry, which has a negative impact on the progress and development of the subject.

Key Words: dentistry, technology, technological resources, oral health, review.

1. Introduction

In recent years, digital dentistry has achieved exponential development thanks to the use of digital technologies in the area of dentistry. The implementation of digital dentistry has had a significant impact on the daily practice of dental professionals and has improved the quality of patient care (Rekow, 2020). In this sense, a bibliometric analysis can provide a general view of the growth of digital dentistry and the most significant topics in this field. In this article, a bibliometric analysis of the available literature on digital dentistry is carried out. Articles published between 2013 and 2022 in the Scopus database (SBD) were selected. The study aims to identify the most researched topics, the most relevant journals in the field, and the authors with the most outstanding scientific production.

Digital dentistry encompasses a set of technologies and techniques that include digital radiography, intraoral scanning, 3D printing, and CAD/CAM technology, among others (Zaharia, et al., 2017). These technologies have allowed dental professionals to improve the precision and effectiveness of dental treatments and procedures. In addition, they have facilitated the creation of personalized dental prostheses and contributed to improving the quality of life of patients. The implementation of digital dentistry has had a significant impact on clinical practice and has led to numerous scientific publications (Anadioti, Musharbash, Blatz, Papavasiliou, & Kamposiora, 2020). Therefore, a

bibliometric analysis of the published literature can provide valuable information on the progress of research in this context and can facilitate dental professionals in identifying the most relevant trends and topics today.

By examining the quality and quantity of scientific production, an overview of the most relevant topics and trends in digital dentistry can be obtained, as well as the contributions of different countries and authors (Gogos, Kodonas, Fardi, & Economides, 2020). Some of the studies that have been carried out on digital dentistry are: (Rekow, 2020), which describes the advances and innovations, the breadth of the impact, the disruptions and advantages that digital dentistry produces; (Blatz & Rabbit, 2019) where the current state of digital dentistry and the materials used in the office are evident; (Zitzmann, Matthisson, Ohla, & Joda, 2020), where a systematic review was carried out to investigate the current penetration and improvement in educational quality of digitalization in the dental curriculum; (Lin, et al., 2019), In this review, the authors discuss and summarize various 3D imaging technologies and recent advances of 3D digital processing techniques in dentistry to provide new perspective and greater understanding of the current development of 3D printing technologies in dentistry.

In conclusion, this study provides a general view of scientific production in digital dentistry and highlights the most researched topics, the most relevant journals, and the authors with the most outstanding scientific production. This bibliometric analysis can be useful for dental professionals, researchers, and decision-makers in the field of dental health.

2. Methodology

During the last decade, much research has been done on the topic of digital dentistry, which is evident in the large number of bibliometric studies and literature reviews that have been carried out. This shows that it is a relevant topic and of growing interest for the dental community. For this reason, the purpose of this article is to carry out

a meta-analysis of research on digital dentistry between 2013 and 2022, using bibliometric data to analyze variables such as keywords, authors, countries, citations, publications, universities, and journals. This seeks to know the status of co-authorship, the most influential authors, the most relevant publications, the most influential journals, the most prominent countries, and universities, as well as the distribution and trend of the keywords used in the research.

This study was developed using a bibliometric analysis approach of scientific publications related to digital dentistry. It was carried out in two parts: a bibliometric mapping to examine trends in the field and an analysis of keywords indexed in the articles to identify research groups and understand the associated research topics. For this, the SBD was used, which contains a wide variety of scientific publications, summaries, and indexing with full-text links generated by Elsevier Co (Moed, Aisati, & Plume, 2013). The search was limited to publications between 2013 and 2022 that contained the key phrase "digital dentistry." A total of 2,117 publications were obtained and with types of documents: journals, conference proceedings, books, book series.

The VOSViewer software was used to perform the bibliometric analysis, which included co-authorship, bibliographic matching, keyword co-occurrence, and bibliometric metadata citations. Bibliographic coupling was defined as the relationship between two or more publications that share common references. Keyword co-occurrence analysis was used to identify the most significant topics in digital dentistry research over time (Deng & Xia, 2020), while citation analysis allowed the identification of the most influential papers in the field (Lai, 2020).

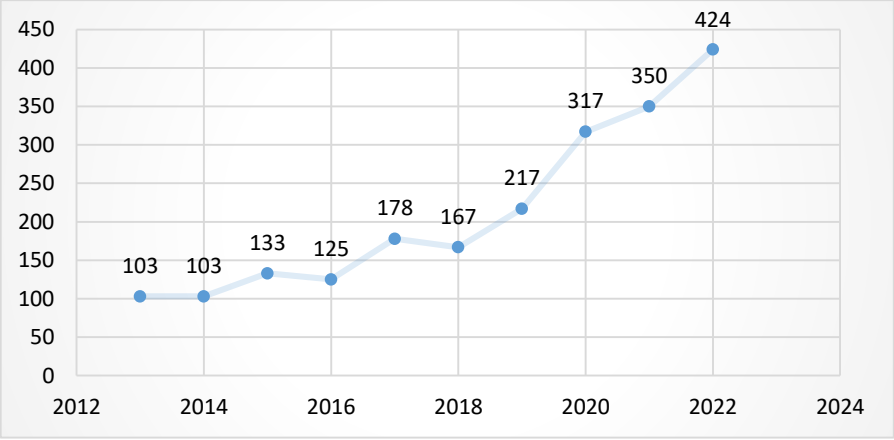
3. Resultados

The results of the analysis are presented in graphs, tables, and network visualization maps. The field analysis was done according to variables such as keywords, authors, countries, citations, publications, universities, and

magazines, in this sense, it will be a matter of knowing: What is the status of co-authorship? Who are the most influential authors? What are the most influential publications? What are the most influential magazines? What are the most influential countries and universities? What is the distribution and trend of keywords?

Figure 1 reflects the number of publications on digital dentistry published each year between 2013 and 2022, which adds up to a total of two thousand one hundred and seventeen documents (2,117) published. The figure shows that the research on digital dentistry is significant and stable, with a range from 103 (2013) to 423 (2022). 103 documents were published in 2013, which represents 4.86% of the publications, and the same amount in 2014; in 2015, 133 documents were published, representing 6.28%; in 2016 it decreased by five units compared to 2015, with 125 documents being published, which represents 5.90%. Likewise, 178 documents in 2017, which represents 8.40%; 167 publications in 2018, which represents 7.88% of the publications; 217 publications in 2019, equivalent to 10.25% of the total publications. By 2020, there is a substantial increase of one hundred (100) more units than in 2019, for that year 317 documents were published representing 14.9% of the publications. In 2021, 350 units were published, representing 16.53% of the publications. Finally, by 2022, 424 documents will be published, representing 20% of the total publications.

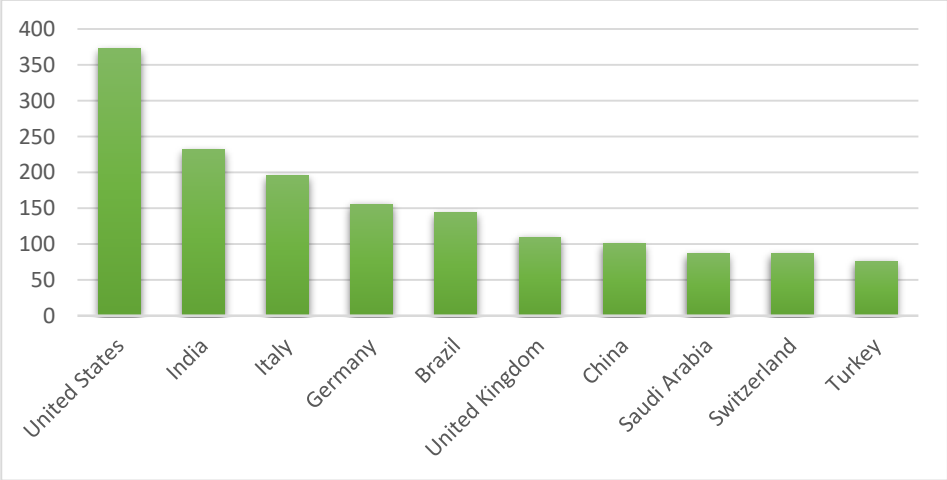
Figure 1. Publication of digital dental education by years



Source: Authors, based on SCOPUS data.

Regarding the countries that published on digital dentistry, the results are displayed in Figure 2. The analysis of the data showed that publications related to digital dentistry cover 101 countries, where the ten most prolific are the United States (373 publications), India (322 publications), Italy (195 publications), Germany (156 publications), Brazil (144), United Kingdom (110 publications), China (101 publications), Saudi Arabia (87 publications), Switzerland (87 publications) and Turkey (76 publications).

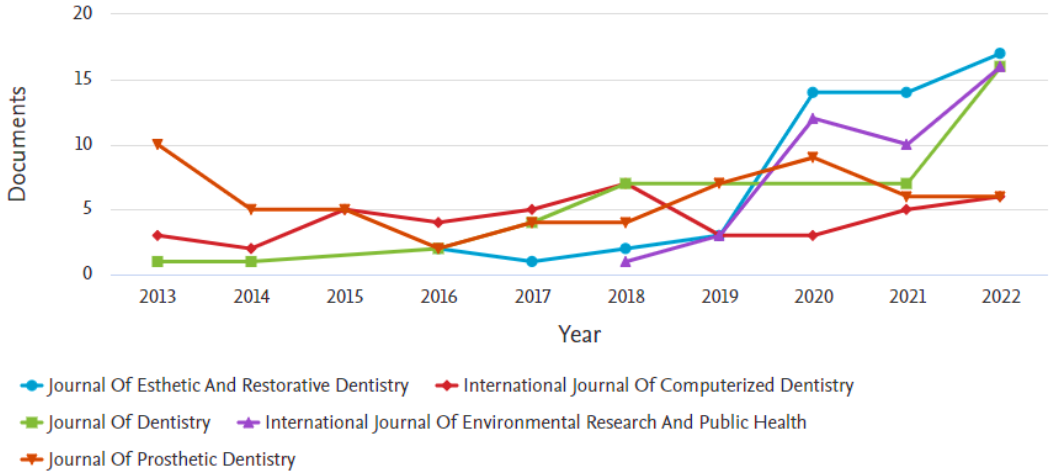
Figure 2. Publication on digital dentistry by country



Source: Authors, based on SCOPUS data.

Regarding the source of publication, the results presented in Figure 3 show that 151 sources were found, where the most prolific and influential are: Journal of Prosthetic Dentistry with 58 publications, Journal of Esthetic and Restorative Dentistry with 53 publications, International Journal of Computerized Dentistry with 43 publications, International Journal of Environmental Research and Public Health with 42 publications, and Journal of Dentistry with 38 publications.

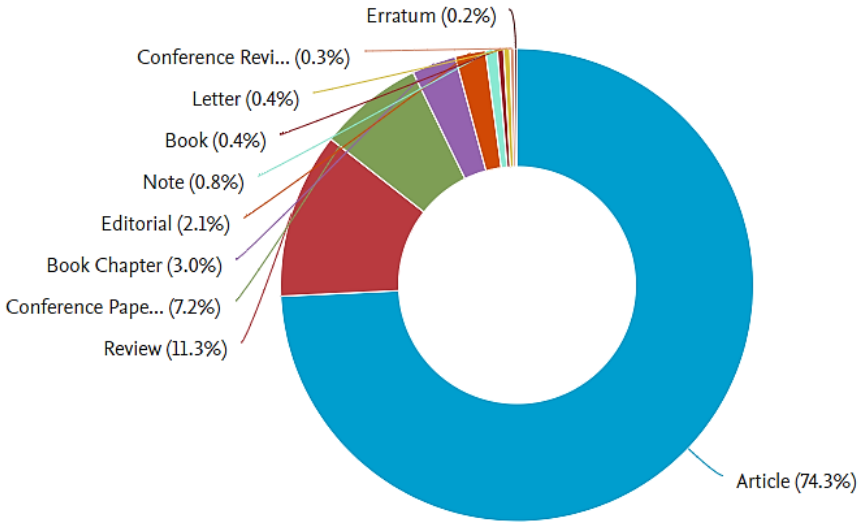
Figure 3. Sources that have published on digital dentistry



Source: SCOPUS.

The analysis also revealed that, among the types of documents published on digital dentistry between 2013 and 2022, 74.3% were articles, 11% were reviews, and 7.2% were conference proceedings, as shown in Figure 4.

Figure. 4 Publicación sobre odontología digital según tipo de documento

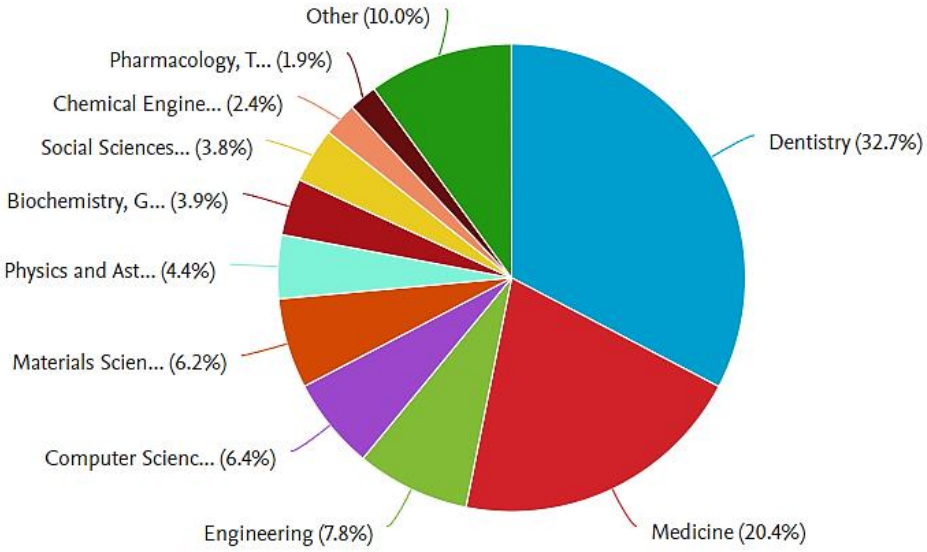


Source: SCOPUS.

Figure 5 outlines the research areas interested in digital dentistry. Among these areas are mainly Dentistry with 32.7% of the publications between 2013 and 2022;

Medicine with 20.4%; Engineering with 7.8%; Computer sciences with 6.4%; and Material Sciences with 6.2%.

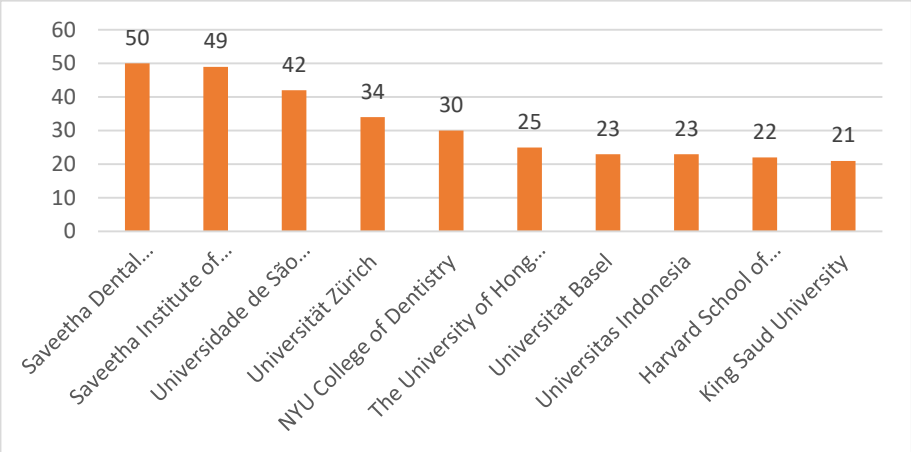
Figure. 5 Publication on digital dentistry according to the area of study



Source: SCOPUS.

As for the top 10 institutions or universities that provide a large production of digital dentistry, Figure shows 6 that there are: Saveetha Dental College And Hospitals with 50 documents, Saveetha Institute of Medical and Technical Sciences with 49 documents, Universidade de São Paulo with 42 documents, Universität Zürich with 34 documents, NYU College of Dentistry with 30 documents, The University of Hong Kong with 25 documents, Universitat Basel with 23 documents, Universitas Indonesia with 23 documents, Harvard School of Dental Medicine with 22 documents, and King Saud University with 21 documents.

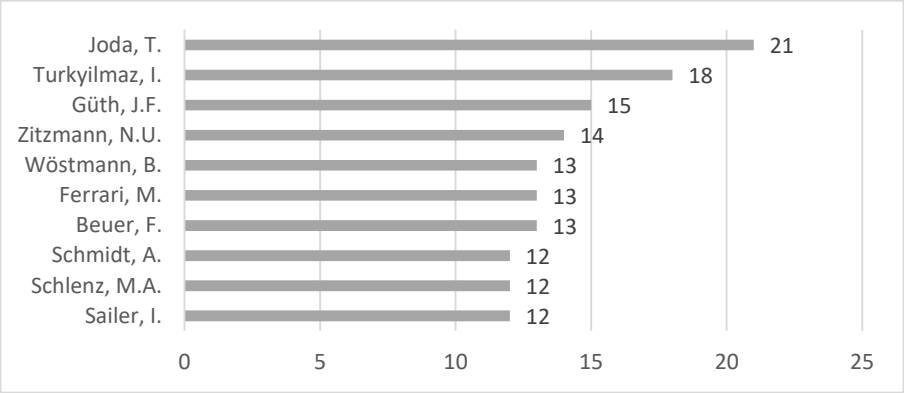
Figure 6. Publication of digital dentistry by institution



Source: Authors, based on SCOPUS data.

Regarding the most prolific authors, as shown in Figure 7, Joda, T. is the author with the highest number of publications in the period examined, with 21 publications, where the most influential document is The complete digital workflow in fixed prosthodontics: A systematic review, cited 196 times. It is followed by Turkyilmaz, I., with 18 publications, where the most influential document is Understanding the complexities of digital dentistry integration in high-volume dental institutions, cited 10 times. The next author with the most publications is Güth, J.F, with 15 publications, where the most cited document is Artificial Neural Networks as a powerful numerical tool to classify specific features of a tooth based on 3D scan data, with 53 citations. It is followed by Zitzmann, N.U., with 14 publications, where the most influential document is Recent trends and future direction of dental research in the digital era, with 50 citations. In this way, it can be seen that even if an author has the greatest number of publications, it does not imply that he or she is the most influential in the scientific community. Those who follow them are Beuer, F., Ferrari, M., Wöstmann, B. all with 13 publications, and then Sailer, I., Schlenz, M., Schmidt, A. with 12 publications.

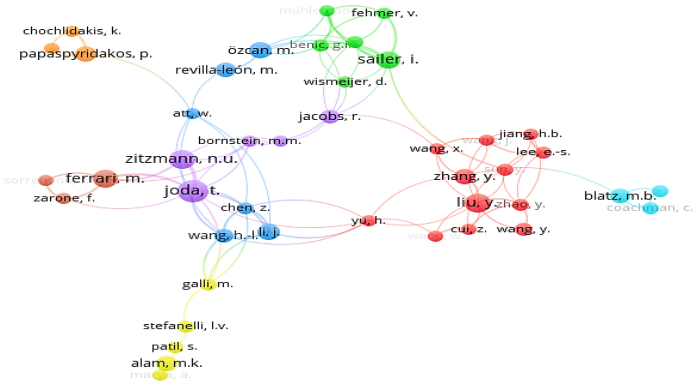
Figure 7. Publication on digital dentistry, most prolific authors



Source: Authors, based on SCOPUS data

For the analysis of collaboration between authors on digital dentistry, authors with at least 5 publications were included, which made it possible to go from 6909 authors to 101 authors. The analysis revealed 8 different clusters, in which only 5 were mostly connected (see Figure 8), and some researchers provided this connection. For their part, groups that are dispersed from the main network are groups that collaborate among themselves or receive few citations from their colleagues in the main network.

Figure 8. Digital dentistry co-authorship network map

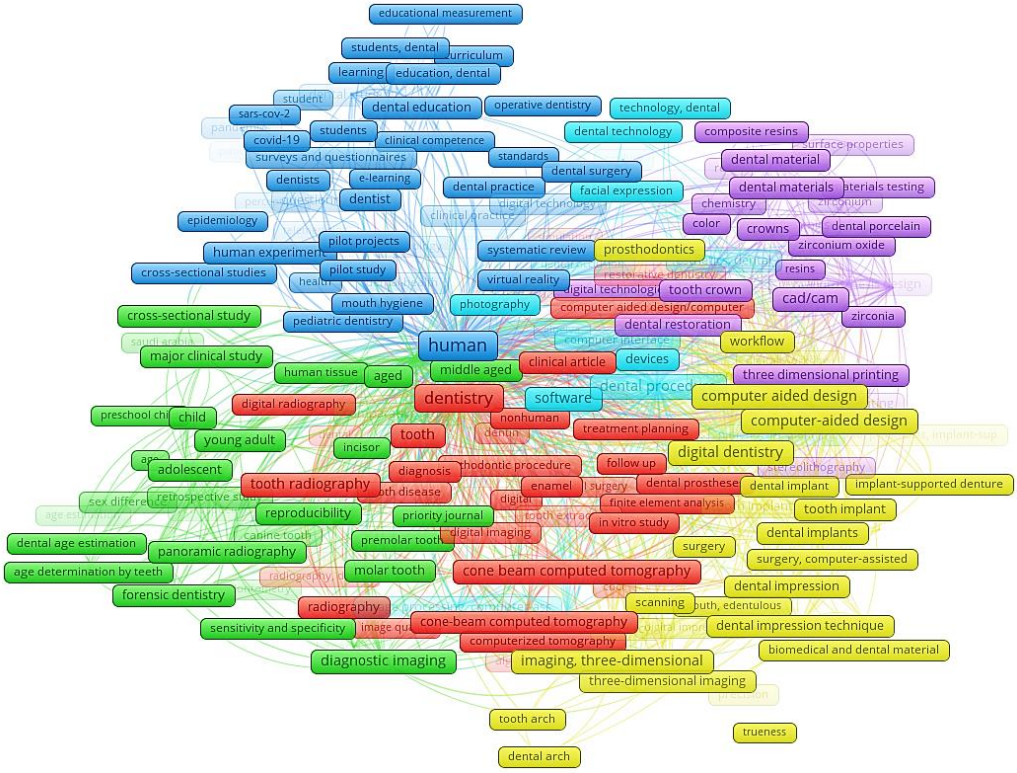


Source: Authors, based on SCOPUS data, analyzed with VOSviewer.

As seen in Figure 8, the cooperative groups of relevant authors are presented in different colors and present the approach to digital dentistry research. When the visualization map of the co-authorship network was examined, it became evident that the cooperation between researchers working on the topic is low even though there are enough authors. Likewise, the number

of active researchers is weak in most groups, with Joda, Lilu, Sailer, and Papaspyridakos standing out the most. Of the 8 groups, the most important are composed of 1 group of 12 authors, 2 groups of 6 authors, 2 groups of 5 authors, and 3 groups of 3 authors. On the other hand, Figure 9 shows the map of the keyword co-occurrence network (MKCN).

Figure 9. Mapa de visualización de MKCN



Source: Authors, based on SCOPUS data, analyzed with VOSviewer.

As shown in Figure 9, the three largest groups are composed as follows: the largest group identified with the color red with 52 keywords highlights words such as dentistry, tooth radiography, digital radiography, among others. The green cluster is the second one with 48 keywords. This includes forencic dentistry, incisor, Young adult, panormaic radiography, adolecent, among others. In the third cluster is the blue one, also with 48 keywords, which includes dentist, oral health, technology, clinical practice, among others, being the most used keywords.

These findings highlight the importance of technology in digital dentistry.

4. Conclusions

This article presents the results of a bibliometric analysis on digital dentistry published between 2013 and 2022. The analysis is based on variables such as keywords, authors, countries, citations, publications, universities and journals. The most influential authors, publications and journals are identified, as well as the most influential countries and universities. The distribution and trends of keywords are also analyzed.

The analysis reveals that research on digital dentistry is significant and stable, with a total of 2,117 publications between 2013 and 2022. The number of publications per year ranged between 103 in 2013 and 424 in 2022. India and the United States are the most prolific countries in terms of publications on digital dentistry, with 322 and 373 publications, respectively. The most influential publications come from the Journal of Prosthetic Dentistry, the Journal of Aesthetic and Restorative Dentistry, the International Journal of Computerized Dentistry, the International Journal of Environmental Research and Public Health, and the Journal of Dentistry. The most common document types published on digital dentistry are articles (74.3%), reviews (11%), and conference proceedings (7.2%).

Research areas interested in digital dentistry mainly include dentistry (32.7%), medicine (20.4%), engineering (7.8%), computer science (6.4%), and materials science (6. 2%). The top 10 institutions or universities that produce the most publications on digital dentistry are Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, University of São Paulo, University of Zurich, NYU College of Dentistry, The University of Hong Kong, University of Basel, Universitas Indonesia, Harvard School of Dental Medicine and King Saud University. The most prolific author is T. Joda, with 21 publications, followed by I. Turkyilmaz with 18 publications, and J.F. Guth with 15 publications.

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