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# 20 YEARS OF DENTISTRY RESEARCH AT WORLD PERSPECTIVES: A SCIENTOMETRIC STUDY

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# 20 YEARS OF DENTISTRY RESEARCH AT WORLD PERSPECTIVES: A SCIENTOMETRIC STUDY

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## ABSTRACT

Dentistry is a branch of medicine that is involved in the study of diagnosis, prevention and treatment of diseases disorders and conditions of the oral function. The study rummages world performances based on its publication output in Dentistry during 1999-2018 (20 years) based on several parameters including a whole country of world's annual average growth rate of publications share and rank Relative Growth Rate (RGR). The study was carried out from Web of Science on Dentistry research at Global perspective. The maximum records published 1536 with 9.62% in 2018 out of 15970 on Dentistry research, whereas the year 1999 is marked by lowest position having 424 records. The majority of publication in Dentistry has been published in the form of Article in journals i.e. 12331 (77.21%). In this study among the top 25 authors, Lang NP is on the top position by publishing 89 articles with h-index score 26 and g-index score 59. It is identified The Four Author contribution the highest in number of publications it is recorded to 10976 (16.69%) and occupies the first rank. It could be found that the county of USA has the highest contributed 3720 articles with highest citation i.e. 58763; whereas the Indian country's minimum of records published in this research was 232 (1.5%) articles. This study is based on Web of Science database. Further research using other databases like Scopus, Chemical abstract, Derwent Biotechnology Abstracts, BIOSIS and PubMed could be attempted.

**Keywords:** Dentistry, Publication output, Relative Growth Rate, Doubling Time, and Web of Science

**INTRODUCTION**

Dentistry, the profession concerned with the prevention and oral disease treatment, including diseases of the dentistry, teeth and support structures and soft tissues of the mouth. Dentistry includes the treatment and correction of malformation of the jaws, misalignment of the teeth, and birth defects of the oral cavity such as cleft palate. In addition to general practice, dentistry includes orthodontics and dental orthopedics, pediatric dentistry, periodontics, prosthodontics, oral and maxillofacial surgery, oral and maxillofacial pathology, endodontics, public health dentistry, and oral and maxillofacial radiology.

Most dental treatments are conducted to prevent or treat two of the most common oral diseases which are dental caries (tooth decay) and periodontal disease (gum disease). Common treatments include tooth restoration, extraction or surgical removal of the tooth, scaling and root planning, endodontic root canal treatment and cosmetic dentistry.

Research is an integral part of a permanent program of people attempts to improve oral health are attempts. In addition, dentist's research is a strong and important part of a development has a rich dental system. Three pillars of higher education sector such as research, education and service for a very long time. Country due to durable time to face important challenges resources are moved around to fill community needs (Madan et al, 2012).

**OBJECTIVES OF THE STUDY**

The main objective of this study to analyses the research performance of Global perspective on Dentistry, as reflected in its publications during 1999 to 2018 (20 years). In particular, the research focuses on the following analysis:

➢ To analyze the status, publication share, rank and growth of world research output on Dentistry
➢ To determine the degree of collaboration of researchers Dentistry research output
➢ To identify the prolific journals distribution on Dentistry research output
➢ To identify the word frequency research output on research
➢ To study the most productive institution of Dentistry Research, and
➢ To study country wise distribution of Dentistry Research

## METHODOLOGY

The study was carried out based on the Scientometric approach at the scholarly writings on dentistry subject field. All data where retrieved from Web of Science database available during 1999-2018 i.e. 20 years. The data retrieved with the basic search in the name of the 'Dentistry' in Web of Science Core data base and with all probabilities. The bibliographical details retrieved were about 15,970 research papers. All data were downloaded based on author affiliation and these records are analyzed on the basis of various quantitative techniques using Bibexcel, R Studio and HistCite.

## PREVIOUS LITERATURE

**(Hossain & Batcha, 2020)** conducted a study on research output published in dental journals during 1999 to 2018 considering qualitative and quantitative measures from around the world. All the records were downloaded from the Web of Science (WoS) online database. The total output was 15970 records from 1635 journals. The results show that the year 2018 was considered the most output with 1411 (8.84%) publications. Among the authors, Lang NP has published the highest number of 89 articles. They concluded, this paper may be considered as a baseline study for the scientometric information related to articles on Dentistry published in the Web of Science.

**(Rahaman, Hossain & Batcha, 2020)** examined performance on the basis of output published in the Oceanographic Research output during 2015 to 2019 from all over the country. A total of 3212 records were retrieved according to the selection criteria from Web of Science database. They focused on various aspect of the Oceanography Research such as growth of publications, prolific authors, document types and organizations involved. They found, the highest number of publication is in the year 2016 with 1179 records, whereas the minimum output published in 2019 i.e. 370. The majority of articles were written by Chen XJ 22 articles. The USA was found to be leading the research with 1144 articles. The researcher suggests for further study of this area research can be carried out the Bradford's Law, Degree of collaboration (DC), and Geographical wise distribution of the Research.

**(Batcha, 2018)** in his article "Scientometric Analysis of Dentistry Research", the data was collected from Web of Science. The search is performed using the basic search, in the name of the dentistry with Web of Science core collection, all publication and bibliographical details of 11,350 research papers. The results of this study included various features of dental literature such as averages literary growth rates, relative growth rate and contribution made by the author in the view of research productivity, author pattern and collaboration.

**(Mohan & Kumbar, 2018)** retrieved the data from Clairvoyant Analytics Web of Science database. Their main objective was to rank highly productive pediatrics research Indian institutions.  All India Institute of Medical Science the highly respected followed the Postgraduate Institute Medical Education and Research (PGIMER) 10.12%. The country of USA with 40.00% contribution is the highly contributing country in pediatrics research. India has the fifth ranked with 4.40% contribution in the highly contributing nations.

**(Ahmad, Batcha, Wani, Khan, & Jahina, 2017)** explored Scientometric analysis of the Webology Journal. It was found that 62 papers were published during the period of study. The maximum numbers of articles were collaborative in nature. The subject concentration of the journal noted was Social Networking/Web 2.0/Library 2.0 and Scientometrics or Bibliometrics. Iranian researchers contributed the maximum number of articles (37.10%). The study applied standard formula and statistical tools to bring out the factual results.

**DATA ANALYSIS AND INTERPRETATION**

**Table 1 Analysis of Year Wise Distribution of Dentistry Publications**

| Year | Articles | Percentage | Cumulative No. of Articles | Cumulative Percentage |
|------|----------|------------|----------------------------|------------------------|
| 1999 | 424 | 2.65 | 424 | 0.32 |
| 2000 | 500 | 3.13 | 924 | 0.69 |
| 2001 | 463 | 2.90 | 1387 | 1.03 |
| 2002 | 469 | 2.94 | 1856 | 1.38 |
| 2003 | 482 | 3.02 | 2338 | 1.74 |
| 2004 | 473 | 2.96 | 2811 | 2.09 |
| 2005 | 495 | 3.10 | 3306 | 2.46 |
| 2006 | 587 | 3.68 | 3893 | 2.90 |
| 2007 | 723 | 4.53 | 4616 | 3.44 |
| 2008 | 765 | 4.79 | 5381 | 4.00 |

| 2009 | 830 | 5.20 | 6211 | 4.62 |
|---|---|---|---|---|
| 2010 | 860 | 5.39 | 7071 | 5.26 |
| 2011 | 901 | 5.64 | 7972 | 5.93 |
| 2012 | 952 | 5.96 | 8924 | 6.64 |
| 2013 | 1224 | 7.66 | 10148 | 7.55 |
| 2014 | 991 | 6.21 | 11139 | 8.29 |
| 2015 | 1034 | 6.47 | 12173 | 9.06 |
| 2016 | 1091 | 6.83 | 13264 | 9.87 |
| 2017 | 1295 | 8.11 | 14559 | 10.84 |
| 2018 | 1411 | 8.84 | 15970 | 11.89 |
| **Total** | 15970 | 100.00 | 134367 | 100.00 |

Table 1 reveals that during the period of 20 years spanned between 1999 and 2018, a total 15970 publications were published by Dentistry researcher. The highest number is found to be 1411 (8.84%) in 2018 followed by 1295 (8.11%) articles in 2017 and 1224 (7.66%) records in 2013. It is also found from the table that the lowest number is 424 (2.65%) records in 1999.

It is inferred from the analysis that there is a most productive year of 2018, 2017, 2016, 2015, and 2013 on Dentistry Research.

**Figure 1 Analysis of Publication Type in Dentistry Research**
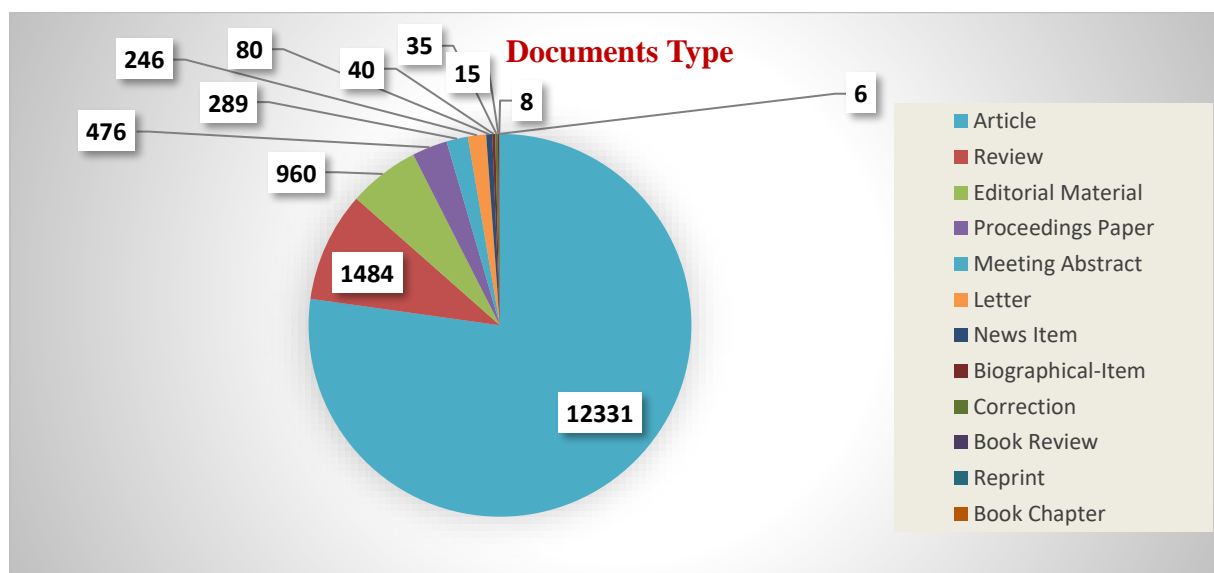


The scholarly publications are brought out in various forms or types (Figure 1). The majority of publication in Dentistry has been published in the form of Journal Article i.e. 12331(77.21%). The authors in Dentistry prefer Review type of publication as their second

choice. It is calculated to 1484 (9.29%) records. The third preferred type of publication is Editorial Material observed among the authors showing 960 (6.01%) in numbers followed by Proceedings Paper reflecting 476 (2.98%). The other forms of publications are less in number.

**Table 2 Analysis of Relative Growth Rate and Doubling Time of Publication**

| Year | Articles | Cumulative No. Of Articles | W1 | W2 | R(a) W2-W1 | Mean R(a) (1-2) | Doubling Time Dt (a) | Mean Dt (a) (1-2) |
|---|---|---|---|---|---|---|---|---|
| 1999 | 424 | 424 | 6.05 | 6.05 | 0.00 | | | |
| 2000 | 500 | 924 | 6.21 | 6.83 | 0.61 | | 1.128473 | |
| 2001 | 463 | 1387 | 6.14 | 7.23 | 1.10 | 0.93 | 0.631624 | 0.68 |
| 2002 | 469 | 1856 | 6.15 | 7.53 | 1.38 | | 0.503789 | |
| 2003 | 482 | 2338 | 6.18 | 7.76 | 1.58 | | 0.438856 | |
| 2004 | 473 | 2811 | 6.16 | 7.94 | 1.78 | | 0.388845 | |
| 2005 | 495 | 3306 | 6.20 | 8.10 | 1.90 | | 0.364941 | |
| 2006 | 587 | 3893 | 6.38 | 8.27 | 1.89 | 1.88 | 0.366296 | 0.33 |
| 2007 | 723 | 4616 | 6.58 | 8.44 | 1.85 | | 0.373812 | |
| 2008 | 765 | 5381 | 6.64 | 8.59 | 1.95 | | 0.355247 | |
| 2009 | 830 | 6211 | 6.72 | 8.73 | 2.01 | | 0.344322 | |
| 2010 | 860 | 7071 | 6.76 | 8.86 | 2.11 | | 0.328931 | |
| 2011 | 901 | 7972 | 6.80 | 8.98 | 2.18 | 2.13 | 0.317863 | 0.32 |
| 2012 | 952 | 8924 | 6.86 | 9.10 | 2.24 | | 0.309661 | |
| 2013 | 1224 | 10148 | 7.11 | 9.23 | 2.12 | | 0.327636 | |
| 2014 | 991 | 11139 | 6.90 | 9.32 | 2.42 | | 0.286424 | |
| 2015 | 1034 | 12173 | 6.94 | 9.41 | 2.47 | | 0.281046 | |
| 2016 | 1091 | 13264 | 6.99 | 9.49 | 2.50 | 2.45 | 0.277427 | 0.28 |
| 2017 | 1295 | 14559 | 7.17 | 9.59 | 2.42 | | 0.286399 | |
| 2018 | 1411 | 15970 | 7.25 | 9.68 | 2.43 | | 0.285607 | |
| **Total** | 15970 | 134367 | | | | 1.85 | | 0.87 |

Table 2 shows the Relative Growth Rate of research output in Dentistry at the Global level. It could be seen clearly that the Relative Growth Rates (RGR) for all sources of Dentistry research output have increased from 0.61 (2000) to 2.12 (2013). The study reveals the fact that the RGR started increasing from 0.61 to 2.43. The overall RGR in the present study calculated is 1.85 and Doubling Time is 0.87. The Mean Relative Growth Rates for the five years of four

blocks are found as 0.93 (1999-2003), 1.88 (2004-2008), 2.13 (2009-2013) and 2.45 (2014-2018) respectively.

The Mean Doubling Time for publications for the five block years are calculated as 0.68 (1999-2003), 0.33 (2004-2008), 0.32 (2009-2013) and 0.28 (2014-2018) respectively. The highest growth of Doubling Time (DT) 1.12 is observed only in the year 2000. It started decreasing from 1999 to 2000 and the form of decrease continues till 2005 i.e. 0.364. The remaining years also follow ups and down in the case of DT of publications. The result of the study validates the fact, when the RGR is increased and DT is decreased.

**Table 3 Analysis of Prolific Authors at Global Dentistry Research**

| Sl. No. | Author | NP | TC | h-index | g-index |
|---|---|---|---|---|---|
| 1 | Lang NP | 89 | 3705 | 26 | 59 |
| 2 | Wang Hl | 53 | 1629 | 22 | 40 |
| 3 | Vallittu PK | 34 | 1421 | 20 | 34 |
| 4 | Matinlinna JP | 38 | 1417 | 19 | 37 |
| 5 | Jacobs R | 34 | 1139 | 18 | 33 |
| 6 | Ozcan M | 34 | 1257 | 17 | 34 |
| 7 | Mjor Ia | 30 | 914 | 17 | 30 |
| 8 | Botticelli D | 58 | 780 | 16 | 24 |
| 9 | Lee JY | 36 | 852 | 16 | 29 |
| 10 | Lynch CD | 45 | 735 | 15 | 25 |

Table 3 indicates the study of author productivity is an important aspect in analysing the performance of research results. The analysis of author productivity examines the prevailing trend in carrying out research in any branch of science. Author Lang NP published highest number of articles for the study period with 89 records, followed by author Botticelli D has published 58 records with 780 citations and published 13 records. Wang Hl has published 53 records with 1629 citations. It concludes from this analysis, the highest h index value is 26 by Lang NP and lowest h index values is 15 by Lyunch CD.

**Figure 2 Analysis of Journal Wise Distribution at Global Dentistry Research**
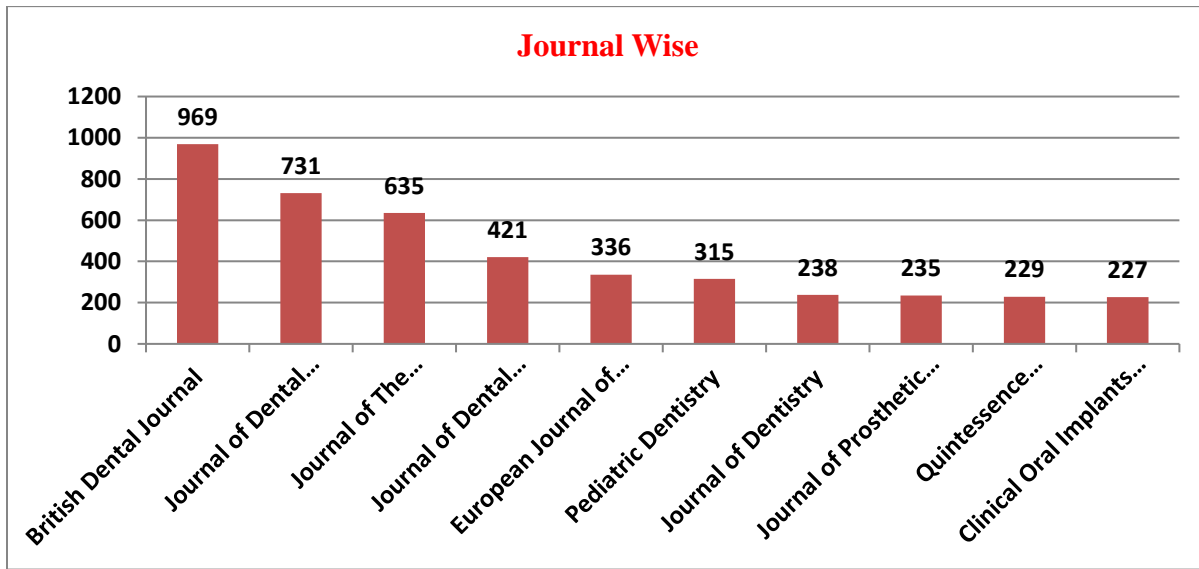


Figure 2 studies the top 10 Journals according to their productivity from 1635 journals. The findings of the table explain that there are 21 core Journals which cover majority of Dentistry literature in specific. British Dental Journal has contributed 969 (6.07%) articles and it stands first rank. Journal of Dental Education published 731 (4.58%) articles and this journal occupied 2nd rank. Journal of the American Dental Association published 635 (3.98%) articles and the rank of this journal is third position. Journal of Dental Research ranked fourth in order which published 421 (2.64%) articles during the period of study and the remaining journals are ranked according to number of their published articles. The inference of this table shows that Journal of Clinical oral implants research is the lowest contribution i.e. 227 articles.

**Table 4 Analysis of Zipf's Law of Words Frequency at Global Dentistry Research**

| Sl. No. | Words | Occurrences | Rank | Log F | Log R | C |
|---------|-------|-------------|------|-------|-------|-----|
| 1 | Dentistry | 1756 | 1 | 3.24 | 0 | 3.24 |
| 2 | In Vitro | 833 | 2 | 2.92 | 0.3 | 3.22 |
| 3 | Children | 646 | 3 | 2.81 | 0.47 | 3.28 |
| 4 | Prevalence | 589 | 4 | 3.76 | 0.6 | 4.36 |
| 5 | Teeth | 575 | 5 | 2.75 | 0.69 | 3.44 |
| 6 | Care | 479 | 6 | 2.68 | 0.77 | 3.45 |
| 7 | Oral Health | 397 | 7 | 2.59 | 0.84 | 3.43 |
| 8 | Education | 389 | 8 | 2.58 | 0.9 | 3.48 |
| 9 | Health | 384 | 9 | 2.58 | 0.95 | 3.53 |
| 10 | Caries | 364 | 10 | 2.56 | 1 | 3.56 |

Table 4 shows the Keyword analysis selecting top 10 Keyword Occurrence. The analysis is based on the Web of Science (WoS) keywords. They are selected and used in the search strategy in an interval of 20 years. The word Dentistry is topped with 1756 times of Occurrence. The next key word In Vitro appeared 833 times, Children 646 times, Prevalence 589 times and Teeth keyword 575 times occurrence respectively. The inference of this table the word Caries is at lowest level which is supposed to happen 364 times.

According Zipf 10 most frequently used words are arranged in decreasing frequency. The applicability of Zipf's law is tested to which the constant the equal value ranging from 3.24 to 3.56. Thus, it is proved that Zipf's law is valid in the present study.

**Figure 3 Keywords Co-occurrence Density Visualization of Dentistry Research**



Keyword analysis provides an opportunity for key discovery research area (Figure 3). A keyword provides a good picture of the network knowledge domain, covered topics and how to provide insights these issues are intellectually connected and organized. Therefore, a keyword co-occurrence network was created using VOSviewer 1.6.8 Software, based on the bibliographic data retrieved from Web of Science. Figure 3 displays a co-occurring keywords network which includes 9 clusters and 1202 links. The high-frequency keywords identified are Dentistry (frequency = 1756), In Vitro (frequency = 833), Children (Frequency = 646), Prevalence ^

(Frequency = 589), Teeth ^ (Frequency = 575), Bcity^ (Frequency = 646), Care^ (Frequency = 479), Oral Health^ (Frequency = 397), and Education ^ (frequency = 389), Health^ (frequency = 384), Caries ^ (frequency = 364) were identified, reflecting the research hotspot in the corresponding period.

**Figure 4 Analysis of Institution Wise Contribution at global Dentistry Research**
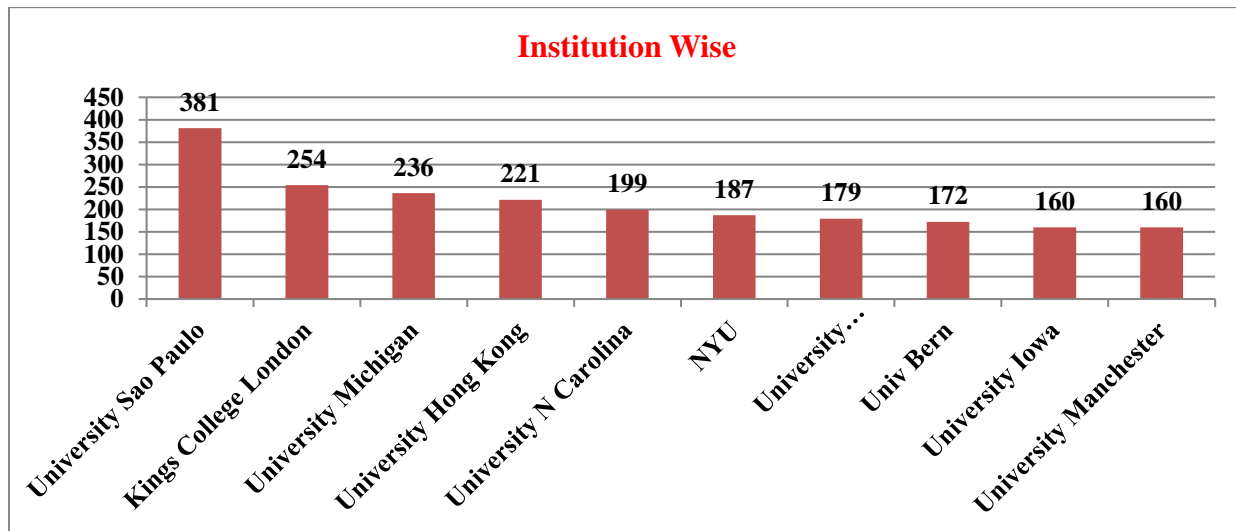


Figure 4 indicates the Institution wise research productivity in the field of Dentistry Research. For analysis top 10 productive institutions were selected. The University Sao Paulo (USA) occupies the 1st rank in order by contributing 381 (2.39%) records of the specified universities over the study period. The Kings College London has contributed 254 (1.59%) articles. It occupies the second place. The University of Michigan has contributed 236 (1.48%) articles. It holds the third position. University of Hong Kong occupies the fourth position which contributed 221 (1.38%). The University of Manchester is on the 10th position with 104 articles contribution during the study period.

**Figure 5 Institutions Density Visualization of Dentistry Research**



The visualization of institutions is perfomred by selecting those instituions that has as atleast 160 publications (10 Institutions). Figure 5 shows a network of instituions of 21 cluster and 8949 links. The University Sao Paulo (381 articles) have made great contributions to Dentistry research, Kings College London (254 articles), University Michigan (236 articles), University Hong Kong (221 articles) and NYU (187 articles), have also made great contributions to the development of Dentistry and played a unique role in the development of this field.

**Figure 6 Analysis of Language Wise Distribution of Dentistry Research**

Figure 6 shows the language wise analysis of scholarly publications on Dentistry. The table explains that the maximum number of publications have been contributed in English language. It is accounted to 15471 records. The data highly support the truth that no other language is able to compete with English language. Germany language holds the second position having 144 articles. In Portuguese language contributed 128 articles. It occupies third position. It could be identified from the above analysis that most of the scientists prefer English language as a medium for their publications for the purpose of sharing scholarly information. As we know that English is the medium of research communication as it is widely recognized all over the world as the same is supported in the present study.

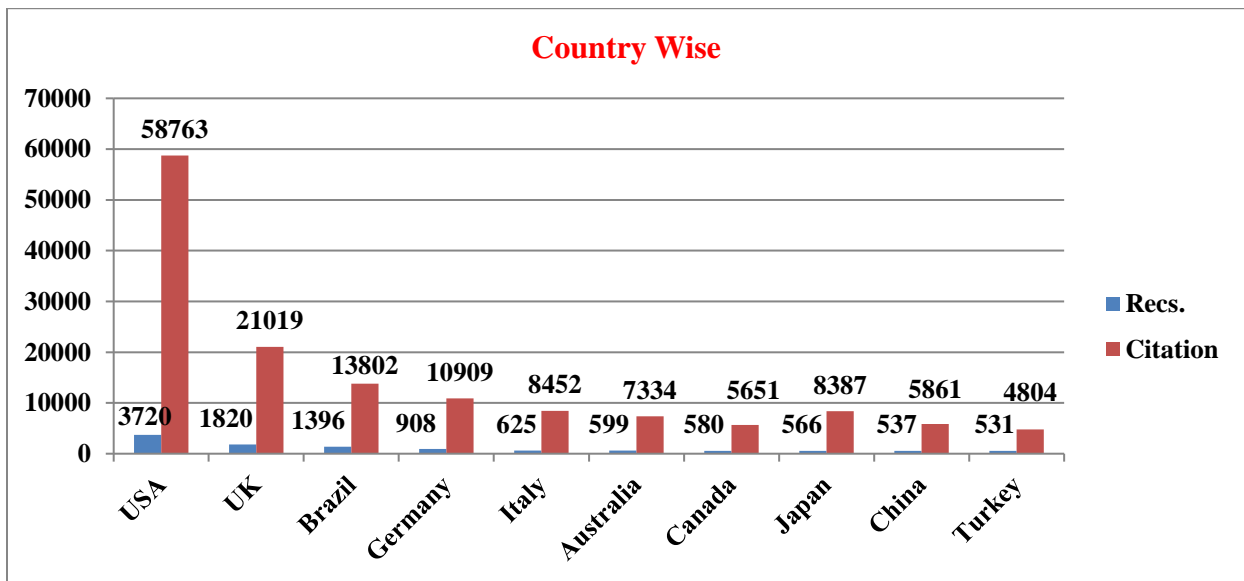**Figure 7 Analysis of Country Wise Distribution at Global Dentistry**



Figure 7 indicates the Country Wise distribution of Dentistry Literature during 1999-2018. During the study period, the researchers elected the top 10 countries output out of 124 countries. Among of 15970 publications, 3720 (24.9%) have been shared by USA. The productivity shared by USA an appreciable hence. It is ranked first. UK comes into the second position which shared 1820 (12.2%) records. Brazil stands by its third position having 1396 (9.3%) records. India holds eighteenth position getting 231 (1.5%) records.

On the other hand it could be found that the county of USA has the highest citation i.e. 58763. UK earned the highest number of citations i.e. 13802. It stands by second rank. Third position goes to Brazil having secured the citation 13802.

**Figure 8 Country Density Visualization of Dentistry Research**
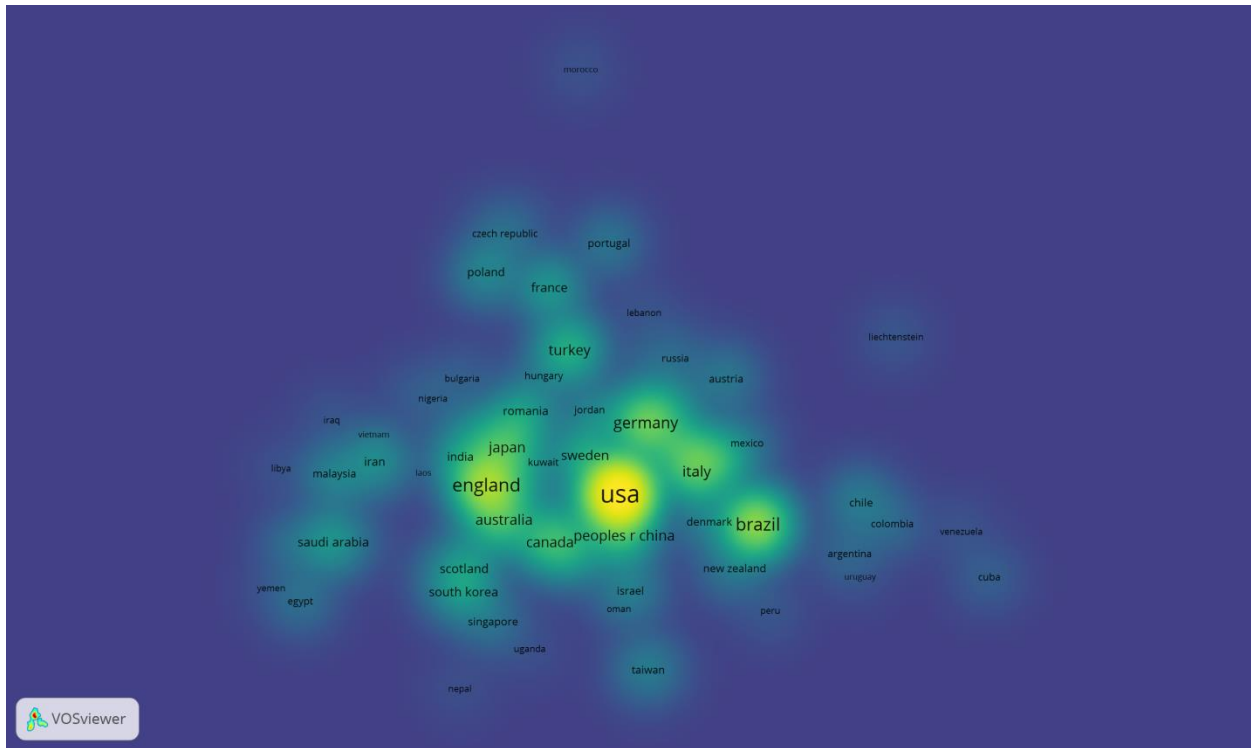


Analysis of output and connectivity amongst the countries based on the affiliation institutions of country (Figure 8). Out of 124 countries from affiliation institutions has published by author. Figure 8 shows a network of instituions of 8 cluster and 71819 links. Each node represnts the country's output and the links between the countries denote the collaborations established through the authorship in the records. Countries such as USA (3720 articles) UK (1820 articles) and Brazil (1396 articles) play key roles in the network and have a connection between different countries and institutions. In the case of citation USA and UK have received more citations whereas Israel has received the lowest citation score i.e. 1821.

**Table 5 Top Five Year and Country Wise Activity Index at Global Dentistry Research**

| Country | 1999-2003 | 2004-2008 | 2009-2013 | 2014-2018 | Total |
|---------|-----------|-----------|-----------|-----------|-------|
| USA | 572 (106.97) | 807 (109.24) | 1060 (95.73) | 1524 94.64 | 3963 |
| UK | 292 (114.69) | 348 (95.18) | 551 (102.04) | 701 89.87 | 1892 |
| Brazil | 143 (69.24) | 181 (62.36) | 463 (108.91) | 670 (110.04) | 1457 |

| | | | | | |
|---|---|---|---|---|---|
| **Germany** | 81 (58.93) | 147 (76.91) | 248 (88.26) | 465 (116.34) | 941 |
| **Italy** | 32 (32.37) | 73 (53.19) | 182 (90.67) | 373 (130.81) | 660 |
| **Others** | 922 (86.07) | 1421 (95.31) | 1958 (89.56) | 2756 (88.71) | 7057 |
| **Total** | 2042 | 2977 | 4462 | 6489 | 15970 |

Table 5 highlights the results of Activity Index of Dentistry Research at the Global level. Activity Index (AI) for the top five Countries has been calculated to analyse how top countries' research performance changes over the span of years. Comparisons of top five countries' research performance with world's research performance have also been made by using Activity Index calculation. The data reveals the individual country's average production and total average production of the country for the study period in Dentistry. The value of AI = 100 indicates that the research effort of a country in a given field corresponds precisely to the world's average; AI>100 reflects higher than average activity and AI>100 lower than average effort dedicated to the field.

USA and UK have shown the above activity in the first block period and other countries have shown below activity. In the second block period alone showed the above activity. UK and Brazil have shown the above activity in the third block period. In the fourth block period Brazil, Germany and Italy have shown the above activity and this block has most above activity.

**CONCLUSION**

On the basis of this analysis the following conclusions, it assumes that Dentistry research output at world in 1999-2018 for 20 years a total of 15970 publications were published at the Global level. The maximum publication is 1536 in 2018. English is the medium of research communication widely recognized all over the world. But a few articles published in other languages in Dentistry research. A single author has contributed 2292 (3.63%), out of 15970 articles. The inference of this table also shows that a Single Author's percentage is the lowest contribution and multiple author i.e. co-author's contribution is very high in Dentistry Research.

The study also found the top authors who have received the highest articles citation published in Dentistry. The author of Lang NP has received the highest citations i.e. 3705 for his

89 publications. The majority of publication in Dentistry has been published in the form of Article in journals. They are counted 12331 (77.21%). The University Sao Paulo has contributed the highest number of research publications with 381.

Scientometric studies work are very important design and development catalogue codes, materials, institutional repositories and a compilation of bibliography for organizing scientific information. It is also useful for research and development work in organization.

## CONFLICTS OF INTEREST

We know of no conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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