Global Orthodontics Research: A Scientometric Analysis

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Abstract:

Scientrometrics as a subject of study is of recent origin in Information Science attracting scholars to work on its various aspects as evaluation of information plays a vital role in policy making and economic planning. This study is an analysis of orthodontics research literature for a period of ten years spanning between 2001 and 2013, (both years inclusive). This research focuses only on quantitative aspects of research publication.

Key words: scientometrics, Information Science, economic planning, orthodontics

INTRODUCTION

Orthodontics is a speciality of dentistry that is concerned with the study and treatment of malocclusion or improper bites which may be a result of tooth irregularity, disproportionate jaw relationships, or both. The extreme expressiveness of the mouth is due in part to its flexibility and wide range of

movement. This range is attributable to the muscular structure that controls the lips under the surface, Hence Orthodontics is the branch of dentistry that corrects teeth and jaws that are positioned improperly. Crooked teeth and teeth that do not fit together correctly are harder to keep clean, are at risk of being lost early due to tooth decay and periodontal disease, and cause extra stress on the chewing muscles that can lead to headaches, Temporomandibular joint (TMJ) syndrome and neck, shoulder and back pain. Teeth that are crooked or not in the right place can also detract from one's appearance. The major research areas in orthodontics are: craniofacial biomechanics,

- ➢ mechanobiology of the periodontal ligament,
- ➢ randomized controlled trials for growth modification treatments,
- ➢ biomechanics of closing loops, sleep studies,
- ➢ obstructive apnea, and
- ➢ clinical oral physiology, including the function of the masticatory muscles and the temporomandibular joint (TMJ).

This paper presents a global view of the trend of research in orthodontics using scientometric tools.

PREVIOUS STUDIES

Saravanan [2] et all carry out a study on contributions in Indian conservative dentists to the medline database during 1996–2009. It was found that majority of the papers were published in international journals and a few in Indian journals. María [4] et all conducted Bibliometric analysis of research on regenerative periodontal surgery for 30 years The evolution of research activity on regenerative periodontal surgery was studied. A small number of authors are highly productive with more than 10 publications on the subject each. Mostly authors have only produced one article on the subject. The co-

authorship average is to publish per paper, with a collaboration between 2 and 6 authors. Main journals on the field of regenerative periodontal surgery are Journal of Period ontology and Journal of Clinical Periodontology, which are ranked 14th and 1st in their category according to the Journal Citations Reports. The most used language is English, followed by Japanese and Italian, Spanish occupying the 8th position. A significant increase on scientific literature is observed, similar to the one Dentistry.

Kumaravel et al(2014)[6] has reported that team research is preferred over individual research especially in medical discipline.

METHODOLOGY

This study "**Global Orthodontics Research: A Scientometrians view"** is a quantitative analysis of records output from Pubmed database that is available online. . The orthodontics records downloaded include   Author, Title, Country, and Year. The size of the sample downloaded is 16772. The downloaded data is examines to general statistical principles and bibliometric laws.

RESEARCH QUESTIONS

This research is an attempt to analyse the research trend in the field of Orthodontics and provide answers to the following Questions
RQ1: What is the trend of Orthodontics research in the world
RQ2: What is the pattern of authorship?"
RQ3.   Whether the bibliometric laws hold good in case of Research output in the field of Orthodontics

Table No 1 Year wise Distribution of Research Productivity

Year	Publications	Percent
2001	991	5.91
2002	991	5.91
2003	1082	6.45
2004	1223	7.29
2005	1141	6.80
2006	1259	7.51
2007	1343	8.01
2008	1474	8.79
2009	1476	8.80
2010	1498	8.93
2011	1529	9.12
2012	1533	9.14
2013	1232	7.35
	16772	100.00

Table 1 displays the year – wise Global distribution of research productivity in Orthodontics for a period of 13 years from 2001 to2013. The total publication count is found to be 16772 and the maximum output occurred in the year 2013 numbering 1533 and this formed 9.14 percent of the total output. The least count of the total output was in the years 2001 and 2002with 5.91 percent. it is found that in terms of numerical count, research literature output in Orthodontics registered a gradual increase excepting fall during three individual years. i.e., 2002, 2005, 2013.

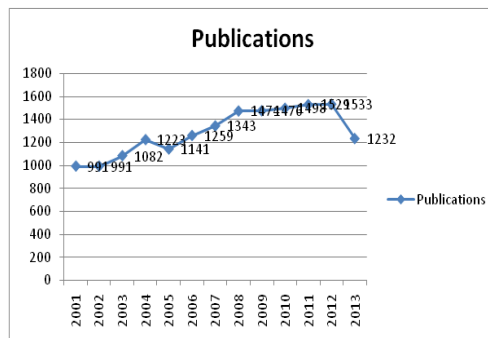**Figure 1 Trend of orthodontics research:**

Table No 2 Orthodontics Research Time series Analysis

year	Publications(x)	x	x²	xy
2001	991	-6	36	-5946
2003	991	-5	25	-4955
2004	1082	-4	16	-4328
2005	1223	-3	9	-3669
2006	1141	-2	4	-2282
2007	1259	-1	1	-1259
2008	1343	0	0	0
2009	1474	1	1	1474
2010	1476	2	4	2952
2011	1498	3	9	4494
2012	1529	4	16	6116
2013	1533	5	25	7665
2014	1232	6	36	7392
13	16772	0	182	7654

Straight line equation is applied to arrive at projections for future growth under Time Series analysis.

Equation   Yc = a+bx
  Since $\sum x=0$
 a $=\sum y/n=16772/13=1290.15$
 b$=\sum xy / \sum x2=7654/182=42.05$
 estimated literature in 2020 is when x= 2020-2007=13
 =1290.15+42.05.19*13=1290.15+546.65=**1836.8**
 Estimated literature in 2025 is when x =2025-2007=18
 =1290.15+42.05.19*18= 1290.15+756.9 = **2047.05**

On the application of the formula of Time Series Analysis and subsequently, from the results obtained separately for the years 2020 and 2025 , it is found that the future trend of growth in Orthodontics research output may take an increasing trend during the years to come. The inferences are that there is a positive growth at the global level in research literature output in Orthodontics research.

Table No 3 Authorship pattern

Authors	publications	Percent
Anonymous	87	0.52
Single	3286	19.59
Joint	2485	14.82
Collaborative	10914	65.07
	16772	100

Research in orthodontics have been done by individual scholars as well as jointly by a team of a maximum of 26 scholars. Authorship pattern is categorised under the traditional types namely, Single, joint and collaborative. Table 3 reveals the relative strength of authorship pattern. It is found that, joint authorship formed 14.82 percent of the total research output. while collaborative authorship formed 65.07 percent and single authorship had a score of 19.59 percent. It is found that collaborative authorship was dominant.

Figure 3 Author ship pattern:
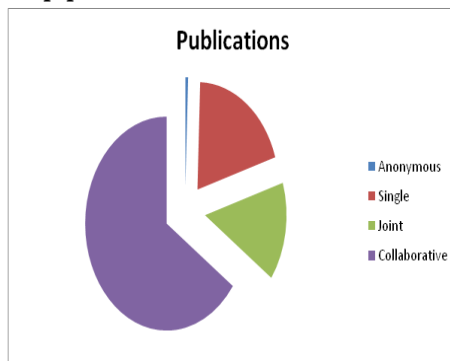
Table No 4 Leading Countries in Orthodontics research

S.No	Country	Count	Percent
1.	USA	2507	14.95
2.	BRAZIL	1195	7.12
3.	GERMANY	936	5.58
4.	JAPAN	877	5.23
5.	TURKEY	791	4.72
6.	UK	745	4.44
7.	ITALY	729	4.35
8.	INDIA	536	3.20

9.	China	522	3.11
10.	CANADA	265	1.58
11.	SWEDEN	252	1.50
12.	Netherlands	229	1.37
13.	SWITZERLAND	204	1.22
14.	FRANCE	192	1.14
15.	Australia	190	1.13
16.	IRAN	187	1.11
17.	SPAIN	169	1.01
18.	TAIWAN	167	1.00
19.	GREECE	158	0.94
20.	ISRAEL	158	0.94
21.	Belgium	143	0.85
22.	HONG KONG	116	0.69
23.	SOUTH KOREA	113	0.67
24.	EGYPT	82	0.49
25.	FINLAND	78	0.47
26.	AUSTRIA	73	0.44
27.	DENMARK	71	0.42
28.	OMAN	66	0.39
29.	IRELAND	58	0.35
30.	THAILAND	53	0.32
31.	NORWAY	52	0.31
32.	Wales	47	0.28
33.	New Zealand	47	0.28
34.	SAUDI ARABIA	46	0.27
35.	JORDAN	45	0.27
36.	Mexico	40	0.24
37.	POLAND	40	0.24
38.	Nigeria	34	0.20
39.	ENGLAND	33	0.20
40.	SINGAPORE	32	0.19
41.	SOUTH AFRICA	26	0.16
42.	LEBANON	26	0.16
43.	PORTUGAL	24	0.14
44.	COLOMBIA	24	0.14
45.	CZECH REPUBLIC	23	0.14
46.	LITHUANIA	22	0.13
47.	Kuwait	22	0.13
48.	Morocco	21	0.13
49.	Serbia	21	0.13
50.	SCOTLAND	20	0.12
51.	Croatia	18	0.11
52.	SLOVENIA	16	0.10
53.	ARGENTINA	15	0.09
54.	Malaysia	15	0.09

55.	PAKISTAN	14	0.08
56.	Syria	12	0.07
57.	SENEGAL	11	0.07
58.	PERU	11	0.07
59.	HUNGARY	9	0.05
60.	Latvia	8	0.05
61.	BULGARIA	8	0.05
62.	NEPAL	6	0.04
63.	TANZANIA	6	0.04
64.	CHILE	5	0.03
65.	CUBA	4	0.02
66.	Benin	4	0.02
67.	Qatar	4	0.02
68.	ICELAND	4	0.02
69.	VENEZUELA	4	0.02
70.	Monaco	4	0.02
71.	MALTA	4	0.02
72.	Iraq	3	0.02
73.	Sudan	2	0.01
74.	RUSSIA	2	0.01
75.	ESTONIA	2	0.01
76.	Kenya	2	0.01
77.	YEMEN	1	0.01
78.	INDONESIA	1	0.01
79.	Uruguay	1	0.01
80.	BANGLADESH	1	0.01
81.	UAE	1	0.01
82.	Slovakia	1	0.01
83.	TOGO	1	0.01
84.	Yugoslavia	1	0.01
85.	SRI LANKA	1	0.01
86.	Macedonia	1	0.01
87.	GHANA	1	0.01
88.	COSTA RICA	1	0.01
89.	Luxembourg	1	0.01
90.	TUNISIA	1	0.01
		16772	100.00

Table 4 details out of the country origin of publications in Orthodontics research. Out of the total 16772 records downloaded 4058 records (24.2%) do not possess addresses of the authors. Hence the present analysis is confined to nearly 75 per cent of the total records downloaded. It is found that the results of research in orthodontics originated from 90 countries

of which United States ranked first forming 14.95 percent of total publication count. Second in the ranked order was Brazil with 7.12 percent and Germany occupied the third rank. India having 536 Publications was in the 9th rank meanwhile China having 522, occupied 10th place.

Table-5 Most profile of author in orthodontics research,

Author Name	Total Count	Percent	Rank
Keim RG	118	7.71	1
Baccetti T	115	7.51	2
Eliades T	102	6.66	3
Franchi L	94	6.14	4
Janson G	92	6.01	5
Anonymous	89	5.81	6
Turpin DL	88	5.75	7
Kuijpers-Jagtman AM	82	5.36	8
Darendeliler MA	75	4.90	9
Uysal T	72	4.70	10
Kim SH	70	4.57	11
Buschang PH	69	4.51	12
Takano-Yamamoto T	62	4.05	13
Major PW	61	3.98	14

The top ranking authors with higher productivity were ranked each according to their publication count. From the Table 5, it is found that Keim RG from United States is found to be the most prolific author among the contributors. Second in the rank was Baccetti T from Italy, followed by Eliades T from Greece.

APPLICATION OF BRADFORD'S LAW OF SCATTERING

Clement Bradford (1934) Published his study on the frequency distribution of papers over journals, he found that '' if scientific journals are arranged in order of decreasing productivity on given subject." they may be divided in to a nucleus of journals more particularly devoted to the subject and several groups or zones containing the same number of articles zones. The same number of articles as the nucleus when the numbers of

periodicals in the nucleus and the succeeding zones will be as " 1:b:b²...." . If the journals are divided into three zones, each containing equal number of papers, they will be in the order of 1:n:n2

Zones	No. of Journals	No. of Publication
Zone 1	4	5747
Zone 2	31	5566
Zone 3	632	5459

Bradford's formula is applied to the publication counts in Orthodontics, Sorting them out in a journals based productivity zones. The total number of journals figured in the present study was 667, which were ranked in a descending order of their publication counts . The categorization of three zones resulted in a ratio 4:31:632 = 1:7.75:158 which is not in the form of $1:n:n^2$ and hence the inference is that the present study do not corroborate with Bradford's law.

Table 6 Lotka's law of Author productivity

No of Papers(X)	No of Authors (Y)	$X^n \cdot y = K$
1 paper	17886	17886
2 papers	4002	18388
3 papers	1602	17960
4 papers	827	17459
5 papers	549	18936
6 papers	349	17978
7 papers	258	18656
8 papers	183	17752
9 papers	136	17095
10 papers	119	18860
11 papers	89	17396
12 papers	72	17042
13 papers	61	17218
14 papers		18274
1 5papers	33	12761
16 papers	33	14708

Lotka deduced a general equation to find out the relation between the frequency 'Y' of persons making 'X' contributions as $X^n Y$= constant (an arbitrary value which he found to be 2). Table 6 displays the application of Lotka's law. It is inferred

from table no 6 that the data for Orthodontics research falls in line with lotka's when n=2 so the application of Lotka' law is proved in this research.

FINDINGS AND CONCLUSION

Considering the significance of this research, it is found that there is gradual growth in Orthodontics research and also research in Orthodontics will grow in the forthcoming years. Though single authored publications occupy nearly one fifth of the total records taken for study, collaborative authorship pattern shows to be the preferred one. As shown in many of the bibliometric studies, USA is the leader in scientific research especially in Orthodontics.   India, being the second leading country in its population has taken only one twenty of the world production and hence it necessitates Indian dentists to concentrate more on Orthodontics research.   Though Lotka's law holds good to some extent, Bradford's law is deviated in Orthodontics research.

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