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Publication Output on Orthodontics Research in Saudi Arabia

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ABSTRACT

Aim: The study aims to present a profile of orthodontics research carried out by Saudi Arabian affiliated authors.

Method: This retrospective study was carried out at King Saud bin Abdulaziz University for Health Sciences. The Web of Science, Clarivate Analytics database was used to obtain the targeted data-set on April 28, 2019. Keyword "Orthodontic" was used in the main search term and the Address option "Saudi Arabia" was written. All the records published up to December 31, 2018, included except letters and notes. The data has been analyzed by using bibliometric indicators, like year-wise distribution and growth; journal's name, its publishing country and impact factor; national productive organization, international research collaborative institutions, productive authors and list of top cited articles. Microsoft Excel spreadsheet was used for data analysis.

Results: A total of 302 papers have been identified by Web of Science on Orthodontics with authorship affiliated to Saudi Arabia. These papers published during 24 years with an average of 12.58 papers per year. These publications received 1,348 citations with an average of 4.46 citations per paper. Majority of papers (n=265; 87.74%) published in the 109 international journals. One hundred and four papers published in 33 journals published from the United States. Top 15 productive organizations of Saudi Arabia, top international research collaborative organizations and productive authors have been calculated. Journals' impact factor and their publications have also been discussed. Citation pattern of open access and subscription-based publication reveals that open access publications have less number of citations.

Conclusion: Upwards trendy of orthodontics research publications found in the recent past. Local researchers should be motivated to cite locally published literature to improve the citation impact of local literature. Research productivity would be increased by opening more postgraduate dental institutes in Saudi Arabia.

Keyword: Bibliometrics, Dental research, Orthodontics, Saudi Arabia

Introduction

Bibliometric is a quantitative analysis to evaluate the characteristics and trends of scientific publications. The findings of bibliometric studies are supporting in decision making and research management process (Haq & Alfouzan, 2017). This method has been frequently used in various branches of health sciences to know the research output, their impact and collaboration (Meo, Hassan & Usmani, 2013).

Scholarly publication is the best mean to communicate the latest trends, best practices, new discoveries and latest ideas to rest of the world to register your worth in global scientific world (Ali & Richardson).

Publications have been considered indispensable for not only the development of specific profession but for a nation even a world as a whole (Haq, Elahi & Dana, 2019).

Saudi Arabia is the largest country in the Arab world and performing a prominent role in education, science &technology and research productivity. Upwards tendency of research activities in medical and allied health sciences have been reported (Bissar-Tadmouri & Tadmouri, 2009).

In local newspaper reported that there are 26 dentistry colleges in Saudi Arabia of which 18 belongs to the public sector and eight are run by the private sector, producing approximately between 2,000 and 3,000 dentists every year. According to the statistics of Saudi Ministry of Health, a total of 5,287 Saudis and 9,729 expatriates are licensed to practice general dentistry in Saudi Arabia (Hazzazi, 2019).

Orthodontic is one of the main branches of dentistry, deals with diagnosis and treatment of dental deformities, facial growth, as well as irregularity in the relationship of lower and upper jaw (Mitchell, 2013). The aim of this study was to estimate the availability of orthodontic literature contributed by Saudi Arabian affiliated authors on Web of Science Indexed journal, and analyze the bibliometric indicators of retrieved dataset.

Methodology

This retrospective study was carried out at the College of Dentistry, King Saud bin Abdulaziz University for Health Science, Saudi Arabia. Institute of Scientific Information, Web of Science (WoS), Clarivate Analytics database has been used to obtain the all bibliographic information on Orthodontics research carried out by Saudi Arabian affiliated authors on April 28, 2019.

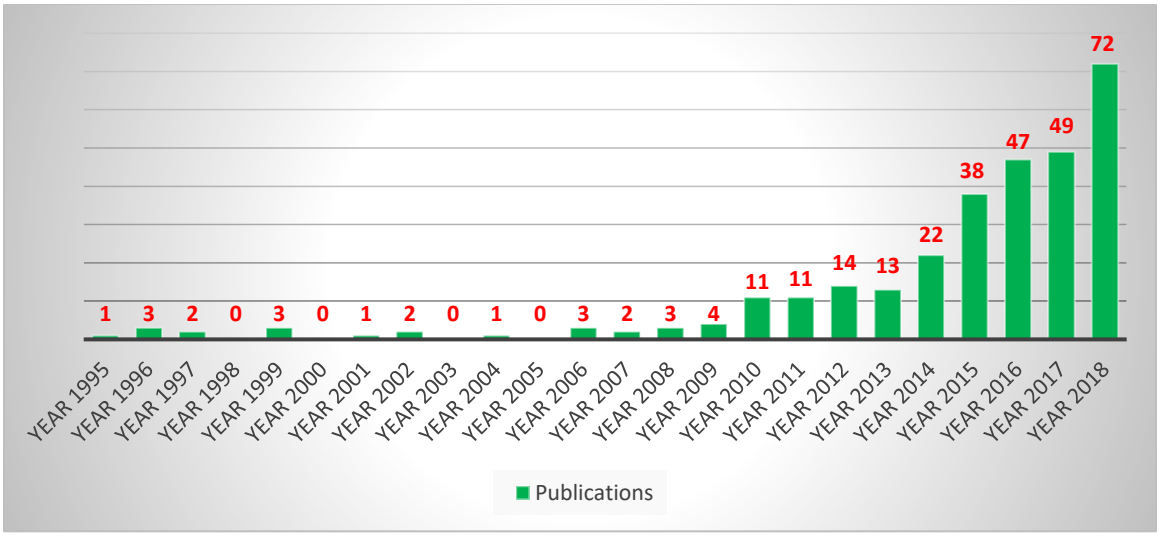
The word "Orthodontic*" has been written in the main search box and select the topic option. Boolean operator AND is applied and in the second search box "Saudi Arabia" has been typed and the Address option has been marked. The documents published in 2019 were excluded as the year 2019 is not yet over and in publications type, the letters and note were also excluded. Other documents types, Article, Review, proceeding papers and meeting abstract published to December 31st, 2018 have been included in the search criteria. For the assessment of the impact factor of journals, the Journal Citation Report of 2017 has been used.

Results downloaded in Comma Separated Value (CSV) file further converted into Microsoft Excel for data analysis.

Results

A total of 302 publications were produced by Saudi Arabian affiliated authors on the topic of orthodontics during the period of 24 years from 1995 to 2018 (Figure-1). This dataset was used as a study sample for analysis. The analysis of document type reveals that bulk of research (n=264; 87.41%) have been conducted in the form of the original research article, followed by review article (n=32; 10.59%), five meeting abstracts and two conference proceeding papers. Only 25 (8.27%) papers have been published during the first 15 years from 1995 to 2009, whereas Saudi authors started its momentum on orthodontic research in 2010 with 11 publications and 72 papers published during the year of 2018. Majority of papers (n=277; 91%) published during last the nine years from 2010 to 2018.

Figure 1; Distribution of Publications on Orthodontics by Year



All 302 documents have been published in 111 journals published from 29 countries. Slightly more than one-third of the total research papers (n=104; 34.43%) published in 33 journals printed from the United States, followed by 55 (18.21%) papers published in 20 journals belonged to England. Forty-one (13.57%) papers published in five locally published WoS indexed journals, 22 papers published in 10 Indian journals and 11 in four journals from New Zealand. There are 11 journals with one article each published from 11 different countries.

Table-1, Distribution of Publications by Journal and its Publications Country

S. No.	Country	Journals	Publications
1.	United States	33	104
2.	England	20	55
3.	Saudi Arabia	5	41
4.	India	10	22
5.	New Zealand	4	11
6.	Germany	4	8
7.	Netherlands	5	8
8.	South Korea	1	7
9.	Switzerland	5	6
10.	Bangladesh	1	5
11.	Australia	1	5
12.	Japan	3	4
13.	Pakistan	1	4
14.	France	1	3

15.	Ireland	2	2
16.	United Arab Emirates	1	2
17.	Italy	2	2
18.	Turkey	1	2
19.	Brazil, Chile, Croatia, Austria, Hungary, Nigeria, Romania, Scotland, South Africa, Sweden & Taiwan	1 Journal from each country	1 publication each

Table-2 describes the status of impact factor of journals that only eight papers published in three journals having impact factor between 4.00 to 7.00 and majority of papers (n=124; 41.05%) published in 29 journals having impact factor between 1.00 to 1.99 and 39 papers published in 21 journals having impact factor less than 1. Seventy-five (24.83%) papers published in 32 journals without any impact factor.

Table-2, Distribution of Documents by Journal's Impact Factor

Rank	Published papers	Number of journals	Impact factor
1	8	3	4.03 – 6.75
2	12	9	3.1 – 3.77
3	44	17	2.03 – 2.88
4	124	29	1.05 – 1.97
5	39	21	0.19 – 0.96
6	75	32	0

A total of 302 items on Orthodontics received 1,367 citations with an average of 4.53 citations per items and overall, 18 publications got H-Index. Table-3 reveals the 15 most productive organizations of Saudi Arabia in orthodontics research. The researchers affiliated to King Saud University produced 128 papers followed by the King Abdulaziz University with 59 papers and Al Jouf University with 17 papers. Citation impact on orthodontic research carried out by the researchers of King Abdulaziz University has been recorded highest.

Table-3, Productive Organizations in Saudi Arabia

S.No.	Organization Name	Publications	Citation	Citation Impact	H-Index
1.	King Saud University	128	673	5.26	14
2.	King Abdulaziz University	59	350	5.93	9
3.	Al Jouf University	17	23	1.35	3
4.	Imam Abdulrahman Bin Faisal University	16	29	1.81	3
5.	Prince Sattam Bin Abdulaziz University	11	17	1.55	2
6.	King Khalid University	10	11	1.10	2
7.	Ministry of Health Saudi Arabia	11	57	5.18	4

8.	Taibah University	9	43	4.78	4
9.	Jazan University	8	16	2.00	2
10.	Princess Nora Bint Abdul Rahman University	8	15	1.88	3
11.	Taif University	7	34	4.86	2
12.	King Saud bin Abdulaziz University for Health Sciences	5	39	7.8	3
13.	Umm Al Qura University	5	20	4.00	3
14.	Riyadh Colleges of Dentistry and Pharmacy	4	5	1.5	1
15.	Riyadh Military Hospital	4	22	5.50	3

Table-4 exposes that the 15 international research collaborative organizations in orthodontics research with Saudi Arabian-affiliated authors. Saudi authors wrote 17 articles in collaboration with the researchers of Erciyes University, Turkey followed by 12 articles with Universiti Sains Malaysia, and 11 each with the State University of New York and the University of London. Highest citation impact (13.67) found in research collaboration with Gulhane Military Medical Academy, Turkey.

Table-4, International research collaborative organizations

S. No.	Organization Name	Publications	Citations	Citation Impact	H-Index
1.	Erciyes University, Turkey	17	213	12.53	9
2.	Universiti Sains Malaysia	12	12	1.00	3
3.	State University of New York	11	27	2.45	2
4.	University of London	11	53	4.82	4
5.	Izmir Katip Celebi University	10	122	12.2	5
6.	Alexandria University	9	28	3.11	3
7.	University of Alberta	9	41	4.56	3
8.	Cairo University	8	44	5.5	2
9.	University of Athens	8	46	5.75	5
10.	Al Azhar University	7	17	2.43	3
11.	Queen Mary University London	7	26	3.71	3
12.	University of Gothenburg	7	58	8.29	4
13.	Gulhane Military Medical Academy, Turkey	6	79	13.67	6
14.	Harvard University	6	43	7.17	3
15.	University of Rochester	6	34	5.67	2

Table-5 presents the detail of 15 productive authors, seven productive authors belong to King Saud University, four from King Abdulaziz University and one each from Al Jouf University, King Khalid University, Princess Nourah bint Abdulrahman University and Prince Sattam Bin Abdulaziz University. Dr. Ali H. Hassan of King Abdulaziz University found the most productive author in orthodontic research with 18 publications, also having the highest citation impact in Saudi Arabia. Mohammad Khursheed Alam of Al Jouf University produced 15 articles stands on second in term of the number of publications. Eman A. Alkofide of King Saud University got the second rank in citation

impact with 6.2 citations per article. There are only three authors with ten or more than ten publications on orthodontics in the WoS database.

Table-5, Top 10 productive Saudi Arabian affiliated researchers

S. No.	Researcher	Affiliation	Publications	Citations	Citation Impact	H-Index
1.	Ali H. Hassan	King Abdulaziz University	18	144	8	7
2.	Mohammad Khursheed Alam	Al Jouf University	15	18	1.2	3
3.	Bangalore H. Durgesh	King Saud University	11	24	2.18	3
4.	Abdullah M. Aldrees	King Saud University	9	34	3.78	3
5.	Moshabab A. Asiry	King Saud University	9	13	1.44	2
6.	Khalid Hashim Zawawi	King Abdulaziz University	9	29	3.22	3
7.	Ibrahim Alshahrani	King Khalid University	8	6	0.75	2
8.	Mona Aly Abbassy	King Abdulaziz University	7	18	2.57	2
9.	Youssef S. Al Jabbari	King Saud University	7	40	5.71	4
10.	Sahar F. Albarakati	King Saud University	7	24	3.43	3
11.	Ahmed Samir Bakry	King Abdulaziz University	6	16	2.67	2
12.	Abdulaziz A. Alkheraif	King Saud University	5	14	2.8	2
13.	Dalya Al-Moghrabi	Princess Nourah bint Abdulrahman University	5	10	2	2
14.	Eman A. Alkofide	King Saud University	5	34	6.8	3
15.	Ali Alqerban	Prince Sattam Bin Abdulaziz University	5	11	2.2	1

Table-6 reveals the journals with the number of publications as Saudi Arabian researchers published their research in 111 journals of the world. Amongst the top ten journals, the American Journal of Orthodontics and Dentofacial Orthopedics and Angle Orthodontist stand on top with 25 papers each, both journals published from the United States. Saudi Medical Journal and Saudi Dental Journal published 22 and 15 papers respectively stand on third and fourth rank. England based, European Journal of Orthodontics ranked fifth with 12 papers. The papers published by Saudi authors in Angle Orthodontist got the highest citation impact (12.2).

Table-6, Top 10 Journals with Maximum Articles

S.No.	Journal's Title	Publishing Country	Papers	Impact factor	Quartile factor	Citations	Citation Impact
1.	American Journal of Orthodontics and Dentofacial Orthopedics	United States	25	1.84	Q2	263	10.52
2.	Angle Orthodontist	United States	25	1.59	Q3	305	12.2
3.	Saudi Medical Journal	Saudi Arabia	22	1.05	Q3	63	2.86
4.	Saudi Dental Journal	Saudi Arabia	15	0	0	30	2
5.	European Journal of Orthodontics	England	12	2.03	Q2	66	5.5
6.	Progress In Orthodontics	England	7	1.25	Q3	21	3
7.	Korean Journal of Orthodontics	South Korea	7	1.61	Q2	17	2.43
8.	Journal of Biomaterials and Tissue Engineering	United States	6	0.78	Q4	8	1.33
9.	BMC Oral Health	England	6	1.6	Q2	21	3.5
10.	Orthodontics & Craniofacial Research	United States	6	2.07	Q2	22	3.67

Table-7 shows the list of 10 most cited papers on orthodontics. These papers published for eight years from 2004 to 2016. Four articles published in the American Journal of Orthodontics and Dentofacial Orthopedics and the same number of articles published in The Angle Orthodontist.

Table-7 Top 10 Most Cited Papers on Orthodontics

S. No.	Publication's detail	Citations
1.	El-Bialy T, El-Shamy I, Graber TM. Repair of orthodontically resorption by ultrasound induced root in humans. Am J Orthod Dentofacial Orthop. 2004;126(2):186-93.	47
2.	Hassan AH, Amin HE. Association of orthodontic treatment needs and oral health-related quality of life in young adults. Am J Orthod Dentofacial Orthop. 2010;137(1):42-7.	45
3.	Yagci A, Veli İ, Uysal T, Ucar FI, Ozer T, Enhos S. Dehiscence and fenestration in skeletal Class I, II, and III malocclusions assessed with cone-beam computed tomography. Angle Orthod. 2011;82(1):67-74.	37
4.	Hassan AH. Cephalometric norms for Saudi adults living in the western region of Saudi Arabia. Angle Orthod. 2006;76(1):109-13.	35
5.	Baysal A, Karadede I, Hekimoglu S, Ucar F, Ozer T, Veli İ, Uysal T. Evaluation of root resorption following rapid maxillary expansion using cone-beam computed tomography. Angle Orthod. 2011;82(3):488-94.	34
6.	Fadlallah SA, El-Bagoury N, El-Rab SM, Ahmed RA, El-Ousamii G. An overview of NiTi shape memory alloy: corrosion resistance and antibacterial inhibition for dental application. J Alloys Compd. 2014;583:455-64.	27

7.	Hajrassie MK, Khier SE. In-vivo and in-vitro comparison of bond strengths of orthodontic brackets bonded to enamel and debonded at various times. Am J Orthod Dentofacial Orthop. 2007;131(3): 384-90.	26
8.	Al Mulla AH, Kharsa SA, Kjellberg H, Birkhed D. Caries risk profiles in orthodontic patients at follow-up using Cariogram. Angle Orthod. 2009;79(2):323-30.	25
9.	Masoud M, Masoud I, Kent Jr RL, Gowharji N, Cohen LE. Assessing skeletal maturity by using blood spot insulin-like growth factor I (IGF-I) testing. Am J Orthod Dentofacial Orthop. 2008;134(2):209-16.	24
10.	Akram Z, Safii SH, Vaithilingam RD, Baharuddin NA, Javed F, Vohra F. Efficacy of non-surgical periodontal therapy in the management of chronic periodontitis among obese and non-obese patients: a systematic review and meta-analysis. Clin oral investig. 2016;20(5):903-14.	22

Discussion

This is the first bibliometric study on orthodontic research output by Saudi Arabian authors based on the bibliographic citations collected from the Web of Science database. A total of 302 research items published in 111 journals found in this database. There are 91 journals indexed in the InCite Journal Citation Report of 2017 under the category of "Dentistry, Oral Surgery and Medicine", nine journals belong to Orthodontics. One hundred and twenty-eight (42.38%) articles published in 35 journals included in the category of "Dentistry, Oral Surgery and Medicine", while 84 articles published in 8 journals related to orthodontics. The other 44 articles published in non-orthodontics journals.

Citation metrics are frequently used in the bibliometric analysis (Jabeen, 2019). In the present study, 108 (35.76%) papers have not been cited yet, while 194 (64.23%) publications received 1,348 citations with an average of 6.94 citations per article. WoS divided targeted publications into two groups, open access and access by subscription, 168 (55.62%) publications have been accessed openly while other 134 (44.37%) publications are not open access. Open access papers received 673 (4.01 citations per article) citations whereas non-open access publications got 694 (5.17 citations per article) citations. More than half of the publications on orthodontics published in open access WoS indexed journals. Open access publications received less number of citations as compared to subscription-based publications.

The majority of research produced by two universities, King Saud and King Abdulaziz University, both these universities are old and having competent research experts and facilities. Most of the productive authors also belong to these universities.

A 2013 study evaluated the top-cited 100 articles on orthodontics published from 1975 to 2011. A majority of articles (n=74) published in the American Journal of Orthodontics and Dentofacial Orthopedics followed by The Angle Orthodontist (n=15). In top-cited articles, 95% of articles were published more than a decade ago. Our study also proved that these journals have been used frequently by Saudi authors to submit their research (Hui et al. 2013).

A 2018 study reported the highly cited orthodontic articles published from 2000 to 2015. Eighty h-classic articles were selected for analysis. These 80 articles received 9294 citations with an average of 116.2 citations per article. Less than half (n=36) of articles published in orthodontics journals and the majority of articles (n=23; 28.8%) published in the American Journal of Orthodontics and Dentofacial Orthopedics (Prevezanos, Tsolakis & Christon, 2018).

Primo et al. (2014) conducted a bibliometric study on 635 research papers on orthodontic produced by Brazilian authors during the period of 10 years. This study revealed the clinical information of articles that the majority of articles follow the Cohort study design, dental material was preferred area of knowledge and the majority of publications were originated from the United States. Future researchers can discuss the study and knowledge domain of orthodontic research published by Saudi authors. Ghana et al. (2013) studied on Indian contribution on orthodontics research as reflected on PubMed database, 242 papers were published from 1990 to 2011. Fifty papers were published in the Journal of Clinical Orthodontics and Institutes in Karnataka found productive institute with 91 publications. Saudi Arabian contributions to orthodontics on the results of the PubMed database can be carried out in the future.

Bibliometric assessment not only provides the scientific control of publications but also provides the intellectual progress of a discipline (Trindade, Placido and Ferreira, 2008). The research on Orthodontic started in 1995 at Saudi Arabia but there has been a remarkable growth after 2014.

Conclusion

Saudi Arabian researchers are contributing significantly to orthodontics literature during the last decade. The quantity and quality of papers are getting better, but there is important to conduct more research on novel ideas by using modern techniques. Researchers should cite the locally published literature in their research, so the citation impact of local literature, authors and institutions have been improved. There is a need to introduce more postgraduate dental research institutions in the country to accelerate the research productivity.

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