



Research article

The orthodontic research trends in Arab League Nations from 2002 to 2021: A bibliometric appraisal

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ABSTRACT

The evaluation of publication growth is a vital indicator to assess any branch of knowledge. The present study aimed to investigate the Scopus-indexed publications on orthodontics produced by the Arab League Nations in the last two decades (2002–2021). Quantitative research method based on bibliometric analysis has been used and the meta-data for the study was retrieved from Elsevier's Scopus database on November 14, 2022. The bibliographic description of all types of literature published on orthodontics from 2002 to 2021 by the authors affiliated with the Arab countries has been downloaded. The selected bibliometric indicators of the data were analyzed by using Microsoft Excel, VOSviewer and SPSS software. The Arab League Nations contributed 5.02 % to global orthodontic research. This segment has demonstrated an amazing escalation of documents from a global perspective between 2002 and 2021 from 1.24 % to 10.94 %. Slightly more than 60 % of documents were published during the last five years of study (2017–2021). The highest number of documents (41 %) was produced by Saudi Arabia, whereas documents contributed by Jordan gained the maximum citation impact. The majority of collaboration was done with the United States, but documents produced in collaboration with Turkey gained the highest citation impact. The paper highlighted that the share of Arab League Nations in orthodontic research has been growing, and Saudi Arabia emerged as the most productive country. The constructive evolution of orthodontic literature with international collaboration display an ambitious approach by Arab countries.

1. Introduction

Orthodontics is a crucial sub-category of dentistry, which deals with the prognosis and treatment of dental deformities, facial

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development and indiscretion in jaw [1]. There are twenty-two Arabic-speaking countries (Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates (UAE) and Yemen) comprised as Arab League Nations. This region had been the epicenter of the exploration of knowledge and scientific discoveries for many centuries [2]. After the wide slit of neglect over many centuries and colonization of the number of Arab states, the revival of learning re-emerged during the 1970s and 1980s. The higher education system was reformed, new institutions were established, and the government patronized the research activities. The outcome of these efforts can be observed in the splendid growth of scholarly as well as scientific publications [3].

Bibliometric research technique has been quite frequently used to assess and quantify the academic literature. The findings of bibliometric studies in dentistry are worthwhile for scheduling the present and future priorities of research and support the management to align the research with contemporary dental practice and education [4,5]. Bibliometric assessments required the source for meta-data. Mostly reputed institutions have been archiving their publications' data in their internal information system which can be extracted for decision-making in the research management process. Usually, external sources of data are required, such as Web of Science, Scopus, PubMed and Google Scholar etc. [6]. In the present study, Scopus was used as a source for meta-data, because this database provides widespread coverage of globally produced interdisciplinary literature. Bibliographic records with abstracts and citation count published in more than 40,000 sources, including journals, conference proceedings, book-chapters and books are being regularly indexed in Scopus [7].

Ahmed et al. [2] reported that Egypt, Saudi Arabia and Tunisia had been the most productive countries in the Arab League Nations from 1980 to 2020 while Somalia, Comoros and Djibouti contributed the least number of publications. The ratio of international collaboration was found approximately in half of the publications (49.21 %) [2]. A recent study analyzed 1557 papers on dental research produced by Saudi Arabia from 2000 to 2020 based on the level of evidence and 78 % of the papers were related to level four evidence. An incredible growth was observed as only 11.62 % of the papers were published in the first eleven years (2000–2010), while 88.38 % of papers were published during the next ten years (2011–2020) and about one-third (35.58 %) of the papers were produced with international collaboration [8].

A study on orthodontic research in Saudi Arabia examined the 302 papers published from 1995 to 2018 and these papers were cited with an average of 4.46 cites/paper. About 88 % of the papers were published in international journals and 104 papers were published in 33 journals published from the United States [1]. Prevezanos et al. [9] studied the 80 highly cited articles on orthodontics published between 2000 and 2015. These articles were cited 9294 times with an average of 116.2 cites/paper. More than one-fourth (29 %) of the articles were published in *American Journal of Orthodontics & Dentofacial Orthopedics* followed by *Angle Orthodontist* (9 %). The highest number of articles contributed the authors belonged to the United States followed by the United Kingdom.

Up to our knowledge, no study investigated the contribution from any authors or institutions from the Arab League Nations in the field of orthodontics. Therefore, our study could motivate the authors of Arab League Nations to conduct studies on innovative and state of the art issues to attract attention from the global academia. It will also identify the strengths and weakness in the current trend in orthodontic research in this region enabling better understanding of the available opportunities and current challenges. Moreover it will be an eye-opening for future collaborative projects in multi-center randomized clinical trials as it will identify potential global cooperation. The current study aims to assess the bibliometric indicators and prospects of orthodontic research contributed by authors affiliated with the Arab World. The meta-data for the current study was retrieved from the Scopus database. The study is intended to address the following questions:

RQ1. What is the global publication output on orthodontics literature and what is the share of the Arab World from the year 2002–2021?

RQ2. What is the periodic growth of orthodontic literature with citation impact and number of authors per document in the Arab World?

RQ3. What is the authorship pattern with the size of citations?

RQ4. Which are the document types and accessibility models with citation count?

RQ5. Which are the top 15 most preferred sources of publications?

RQ6. What is the research collaboration pattern by countries?

RQ7. What are the subject categories of orthodontics to determine the strong and weak areas of research?

2. Material and methods

2.1. Data bases and keywords

We employed the bibliometric research method to evaluate the publication output on orthodontic literature produced by the authors affiliated with the Arab League Nations. Bibliometric is a quantitative technique to assess the pattern and trends of scholarly output. The required dataset was retrieved from the Elsevier's Scopus® database [10]. The following search strategy was performed on November 14, 2022. In the main search box of Scopus, the word "Orthodontic*" was written. The smart searching technique "truncation", was used, the asterisk (*) has been added instead of the last alphabet to expand the search and to detect all literature beginning with the same word. Mavropoulos and Kiliaridis applied the same technique to extract the papers on orthodontics from the PubMed

database [11]. Further, we applied the year filter and selected the years from 2002 to 2021 and excluded all years before 2002. The year 2022 was not included as it has not been over on the date of data collection. Also, It was decided to include studies up to 2021 only in this bibliometric analysis to allow for reasonable time for citations to build on. After this, we applied the second filter from the country index, we selected the Arab countries and clicked the limit option in the Scopus database. Out of 22 Arab countries, only 19 countries were found, to have any literature on orthodontics. We didn't find any documents on orthodontics contributed by the authors affiliated with Somalia, Comoros and Djibouti.

2.2. Inclusion and exclusion criteria

We included all types of documents produced by the Arab countries on Orthodontics. We didn't apply other filters. Comma Separated Value (CSV) file consisting of bibliographic records of 2231 documents has been downloaded for data analysis. To ensure accuracy, the search query was repeated by two investigators. There was no duplicate record found in the dataset.

2.3. Analysis

Microsoft Excel sheet (version 16, 2022, Microsoft Corp, Redmond, WA, USA), VOS viewer (version 1.6.18, 2022, Leiden University's Centre for Science and Technology Studies (CWTS), Leiden, Netherlands) and software developed by Van Eck and Waltman were used for the analysis of meta-data [12]. The Pearson chi-square test was performed for the statistical analysis. The indicator of open-accessed and non-open-accessed documents was analyzed with Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 20, 2011 (IBM Corp, Armonk, New York, USA). The p-value (<0.05) was considered statistically significant.

3. Results

3.1. Global output on orthodontics

A total of 79,126 documents have been indexed in the Elsevier-Scopus database on orthodontics on the date of data collection and 44,339 documents were published during the study period consisted of two decades from January 1, 2002 to December 31, 2022. This amount ($n = 44,339$) comprised 56 % of total publications on orthodontics. Overall, the United States was on the top with 6917 (15.60 %) documents, followed by Brazil ($n = 4108$), China ($n = 3285$), India ($n = 3197$) and United Kingdom ($n = 2637$) in research productivity. The highest number of papers ($n = 4775$) were published in *American Journal of Orthodontics and Dentofacial Orthopedics (AJODO)*, followed by *Angle Orthodontist* ($n = 2274$) and *European Journal of Orthodontics* ($n = 1584$). The top two most productive institutions belonged to Brazil, *Universidade de São Paulo* ($n = 1098$) and *Universidade Federal do Rio de Janeiro* ($n = 465$) while the third most productive institution, *Sichuan University* ($n = 462$), belongs to China. About 39 % of the documents were published in the first decade (2002–2011), whereas explicit growth (61 %) was recorded in the later decade (2012–2021).

3.2. Share of Arab League Nations in orthodontics publications

Out of a total of 44,339 documents, the Arab League Nations contributed 2231 documents on orthodontics during the targeted period (2002–2021), which consisted of 5.03 % of the total world output. The share of the Arab League Nations was recorded at 1.24 % in 2002, 2.30 % in 2009, 6.03 % in 2016 and reached 10.94 % in 2021. Remarkable growth has been observed, the magnitude of documents has been enhancing with every passing year.

3.3. Periodic growth of documents with citation impact and average number of authors

The period of 20 years has been distributed in five equal intervals of five years each. The gradual growth was recorded from 5.02 % of documents during the first interval to 10.09 % of documents in the second interval. About one-fourth of the total documents were published in the third interval (2012–2016), while an amazing growth was observed in the last five years of study. All these documents gained 20,420 citations with an average of 9.07 citations per document. The older documents gained a higher number of citations as compared to newer documents. Overall, a total of 8536 authors including multiple counts contributed to 2231 documents with an average of 3.82 authors per document. The ratio of average authors per document has increased from 2.70 in the first interval and reached 4.10 authors per document in the last interval (Table 1).

Table 1

Distribution of documents with average citations and authors by intervals.

Intervals (year)	Total Documents (percentage)	Total Citations	Cites/doc	Total Authors	Average Authors per Document
2002–2006	112.00 (5.02 %)	3059.00	27.31	302.00	2.70
2007–2011	225.00 (10.09 %)	4206.00	18.69	732.00	3.25
2012–2016	543.00 (24.34 %)	6736.00	12.41	1957.00	3.60
2017–2021	1351.00 (60.56 %)	6239.00	4.62	5545.00	4.10

3.4. Distribution of documents and citations by countries

Out of 22 countries of the Arab League Nations, only 19 countries contributed to orthodontics research, whereas no document on orthodontics was found against three Arab countries, Somalia, Comoros and Djibouti in the targeted period as reflected in the Scopus database. Saudi Arabia contributed the highest number of documents (n = 923; 41.37 %), followed by Egypt (n = 389; 17.43 %) and UAE (n = 197; 8.83). A slightly more than two-thirds (n = 1509; 67.63 %) of the documents were contributed by these three countries in the Arab World. The analysis of citation impact amongst the top 13 Arab countries having a publication output of more than 20 documents shows that Jordan occupies the top rank in citation impact with an average of 17.84 cites/doc, followed by Kuwait (15.72 cites/doc) and Syria (10.98 cites/doc). Although, Saudi Arabia has been at the top in orthodontic research while it gains the citation impact of 7.99 cites/doc. The minimum citation impact (3.80 cites/doc) was observed with documents affiliated with Iraq. Only top-seven countries (Saudi Arabia, Egypt, UAE, Iraq, Jordan, Lebanon and Syria) contributed more than 100 documents each, while eight countries contributed from the maximum 93 documents to the minimum 17 documents and four countries (Algeria, Oman, Palestine and Mauritania) produced less than 10 documents each (Fig. 1).

3.5. Distribution of documents by authorship patterns

The examination of the authorship pattern reveals that only 292 (13.08 %) documents were contributed by a single-author pattern while the other (n = 1939; 86.92 %) documents have been the result of research collaboration. An in-depth analysis of authorship patterns shows that about one-fifth of the total papers (n = 440; 19.72 %) have been contributed by the three-author pattern and this pattern was found most preferred, followed by four-author and two-author patterns. More than half of the documents (54.05 %) have been written in two, three and four-author patterns. Only 27 documents are found with ten or more than ten authors each. The document written by six-author pattern gained the maximum citation impact (10.39 cites/doc), followed by eight-author pattern and the lowest citation impact (5.60 cites/doc) has been recorded against nine-author pattern. All the multi-author documents inclusively gained 9.18 cites/doc, while the single-author documents cited an average of 7.70 cites/doc (Table 2 and Fig. 2).

3.6. Distribution of documents by types and accessibility modes

The scrutiny of document types and accessibility mode shows that the highest number of documents are written as articles (86.32 %), followed by reviews (8.47 %) and other documents (5.19 %) as shown in Table 3. The review papers gained the highest number of citations as compared to articles and other documents. The Non-Open accessed (subscription-based) articles are cited slightly more as compared to open access articles but this ratio has been observed to reverse in reviews. The open-accessed reviews have been cited higher as compared to non-open accessed review papers. Other documents (n = 166) consisted of book/book chapters (n = 37), conference papers (n = 29), letter (n = 19), short survey (n = 14), editorial (n = 10), note (n = 6), and erratum (n = 1) gained the lowest citation impact. There was no statistically significant difference (p = 0.04) in citations between open and closed-access journals when the Pearson chi-square value was tested.

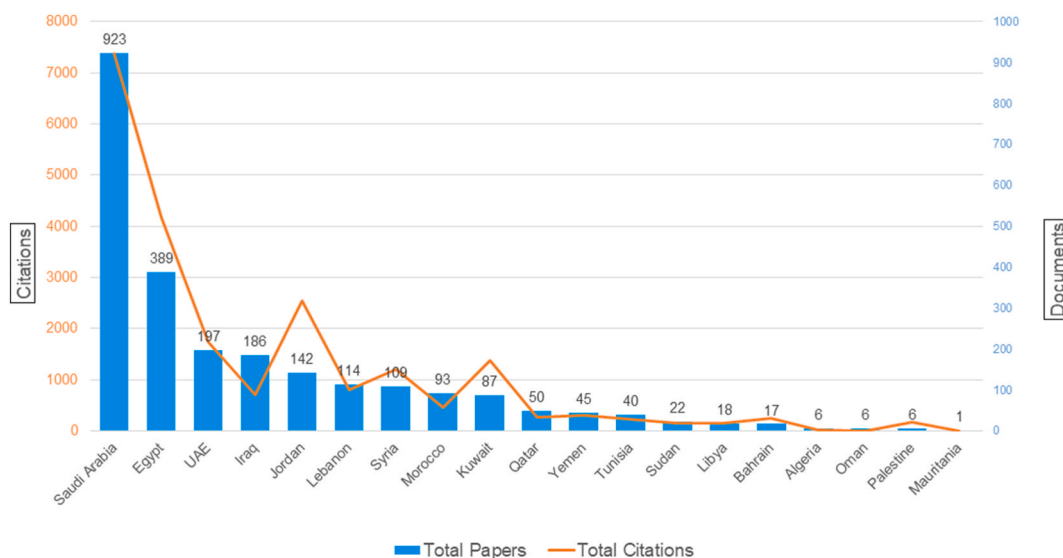


Fig. 1. Distribution of documents and citation by Countries.

Table 2
Distribution of documents by authorship patterns and citation impact.

Authorship Pattern	Total Documents	Total Citations	Citation Impact
Single-author	292.00	2248.00	7.70
Two-author	346.00	2667.00	7.71
Three-author	440.00	4219.00	9.59
Four-author	420.00	3925.00	9.35
Five-author	278.00	2634.00	9.47
Six-author	261.00	2711.00	10.39
Seven-author	103.00	1016.00	9.86
Eight-author	44.00	450.00	10.23
Nine-author	20.00	112.00	5.60
More than nine author	27.00	258.00	9.56
Total Multi-Author document	1939.00	17792.00	9.18

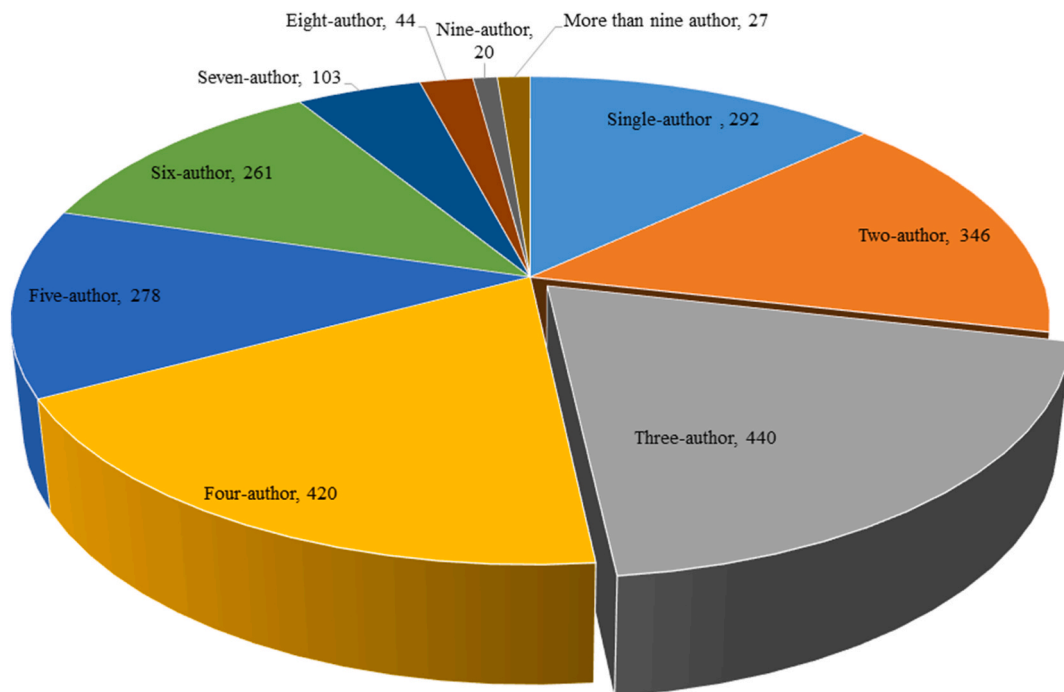


Fig. 2. Distribution of documents by authorship pattern.

Table 3
Distribution of documents by types and accessibility with citation.

Types	Total	Citations	Citation Impact	Open Access	Citations	Citation Impact	Non-Open Access	Citations	Citation Impact
Articles	1926	17288	8.98	981	8036	8.19	945	9252	11.88
Reviews	189	2669	14.12	100	1522	15.22	89	1147	12.89
Other Documents	116	283	2.44	24	81	3.38	92	202	2.20

Statistical Analysis

P= 0.04*

* P<0.05 - Significant - Pearson Chi Square test

3.7. Frequently used sources of publications

A total of 941 (42.17 %) documents have been published in the top 15 sources of publications and these 941 documents gained 55.42 % (n = 11,218) of citations with an average of 11.92 cites/doc. Amongst these sources, four journals are being published from

the United States and three each from United Kingdom and Saudi Arabia, while one each from India, France, Japan, Netherlands and Macedonia. *Progress in Orthodontics* has the highest CiteScore (5.7), followed by the *European Journal of Orthodontics* (CiteScore 5.0), with 40 and 95 documents published each, respectively. The highest number of documents ($n = 147$; 6.58 %) have been published in the *AJODO*, followed by the *Angle Orthodontist* ($n = 120$; 5.37 %) and the maximum citation impact has been gained by the *AJODO* (22.8 cites/doc) followed by the *European Journal of Orthodontics* (21.0 cites/doc). Amongst the three Saudi journals, *Saudi Dental Journal* and *Journal of Orthodontic Science* have published 58 and 57 documents, respectively, and 27 documents published in *Saudi Medical Journal* (Table 4).

3.8. Research collaboration countries

The exploration of research collaboration of Arab countries illustrates in Table 5. The highest number of research collaborations has been done with the United States ($n = 249$) followed by the United Kingdom ($n = 128$). More than one-fourth of the documents ($n = 608$; 27.25 %) on orthodontics produced by Arab countries were the result of researchers collaborated with the top four countries (United States, United Kingdom, India, and Malaysia). Although, the research collaboration with Turkey produced 39 documents and occupies the ninth rank, these documents gained the highest citation impact (20.38 cites/doc), followed by United Kingdom (16.21 cites/doc) and Switzerland (15.92 %). The lowest citation impact was recorded with documents collaborated with Malaysia (5.06 cites/doc), followed by India (5.45 cites/doc) and France (5.55 cites/doc).

3.9. Co-occurrence network of authors

The analysis on VOSviewer revealed that a total of 5063 authors belonging to 103 countries including 19 Arab countries contributed to 2231 documents. The co-occurrence network of the top 40 contributing countries is shown in Fig. 3.

3.10 Frequently used keywords.

A total of 4141 keywords were used by authors in 2231 documents as identified by VOSviewer software, and 206 keywords met the threshold of minimum the occurrence of five times. Fig. 4 shows the top 20 most frequently used keywords and network of these keywords. The keyword, "Orthodontics" was used the highest number of times and link strength followed by "Malocclusion" and "Orthodontic treatment".

4. Discussion

The bibliometric research method is not only used to quantify the literature but it has more innovative possibilities and can support determining the intellectual development of the subject area. The findings of bibliometric pave the track to a futuristic approach to factual medicine [4,13,14]. The meta-data for the current study was collected from the Scopus database. The database was developed by Elsevier in 2004 and this database provides extensive coverage of academic literature [7,15]. Scopus indexed more literature produced in the Asian-pacific region as compared to Web of Science [16].

A total of 44,339 documents on orthodontics have been published worldwide during the last two decades (2002–2021). The authors belonging to Arab League Nations produced 5.03 % of the global literature in orthodontics. Although, the Arab region is lagging behind as compared to developed world but in every passing year, their productivity has been increasing. The year-wise analysis showed that the share of Arab countries in orthodontics was just 1.24 % in 2002 but it is encouraging that the share of Arab countries reached about 11 % from the global perspective in 2021. The authors belonging to Arab countries also contributed valuable research in the Arabic language that has not been indexed in the Scopus database, even than a promising growing tendency shows the aspiring

Table 4
Top-15 most frequently used sources of publications.

Serial No.	Name of Journal	Country	CiteScore	Total documents	Total Citations	Citation Impact
1	American Journal of Orthodontics and Dentofacial Orthopedics	United States	4.10	147.00	3345.00	22.80
2	Angle Orthodontist	United States	4.10	120.00	2213.00	18.40
3	Journal of Contemporary Dental Practice	India	1.50	117.00	607.00	5.20
4	International Orthodontics	France	1.20	113.00	506.00	4.50
5	European Journal of Orthodontics	United Kingdom	5.00	95.00	1994.00	21.00
6	Saudi Dental Journal	Saudi Arabia	3.40	58.00	585.00	10.10
7	Journal of Orthodontic Science	Saudi Arabia	2.20	57.00	297.00	5.20
8	Progress in Orthodontics	United States	5.70	40.00	497.00	12.40
9	International Medical Journal	Japan	N/A	35.00	31.00	0.90
10	BMC Oral Health	United Kingdom	3.60	29.00	253.00	8.70
11	International Journal of Dentistry	United Kingdom	2.70	27.00	175.00	6.50
12	Orthodontics and Craniofacial Research	United States	3.20	27.00	255.00	9.40
13	Saudi Medical Journal	Saudi Arabia	2.10	27.00	250.00	9.30
14	Journal of the World Federation of Orthodontists	Netherlands	1.50	26.00	136.00	5.20
15	Open Access Macedonian Journal of Medical Sciences	Macedonia	1.30	23.00	74.00	3.20

Table 5
Top-15 collaborative countries on orthodontics in Arab World.

Serial No.	Name of Collaborative countries	Total Documents	Total Citations	Citation Impact
1	United States	249.00	3269.00	13.12
2	United Kingdom	128.00	2076.00	16.21
3	India	124.00	677.00	5.45
4	Malaysia	107.00	542.00	5.06
5	Canada	60.00	636.00	10.60
6	Pakistan	51.00	560.00	10.98
7	Greece	49.00	600.00	12.24
8	Germany	41.00	513.00	12.51
9	Turkey	39.00	795.00	20.38
10	Sweden	37.00	482.00	13.02
11	Italy	31.00	357.00	11.51
12	Japan	31.00	207.00	6.67
13	France	29.00	161.00	5.55
14	Switzerland	28.00	446.00	15.92
15	Australia	22.00	265.00	12.04

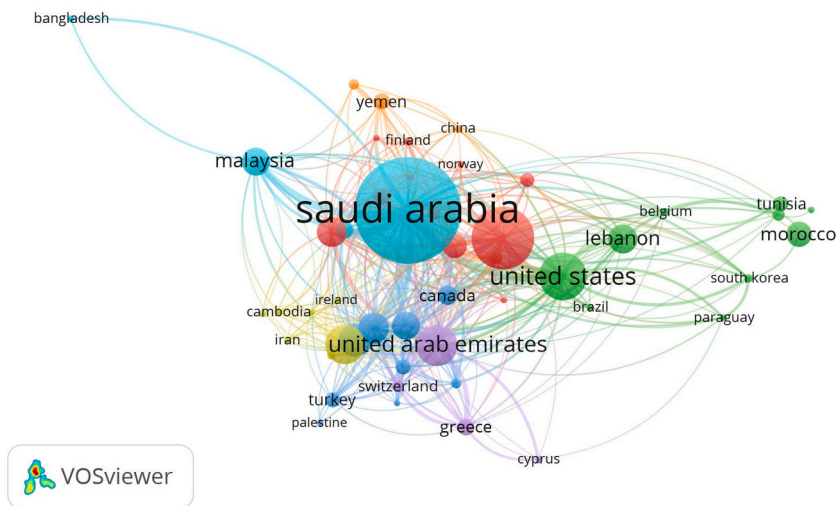


Fig. 3. Co-occurrence network of most contributing countries.

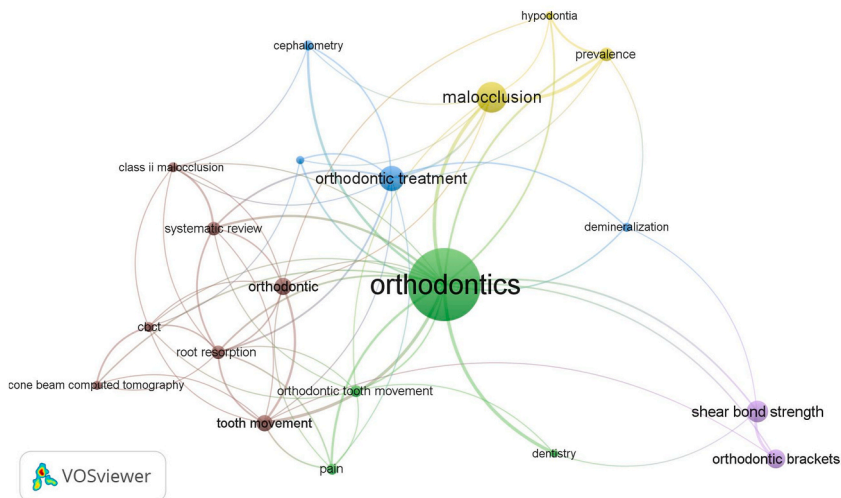


Fig. 4. Co-occurrence network of top 20 frequently used keywords.

attitude. Anas et al. [17] reported that 21 universities in Syria providing dental education in Arabic language. Scimago Journal and Country Rank (SJR) indexed 27,239 journals and other sources in its portal, whereas only 275 journals/sources published from the Arab countries are indexed in this portal [18]. Actual number of journals being published from the Arab League Nations is higher than indexed in the SJR. Arab countries and its respective institutions should try to recognize and index their journals in the accepted databases for the wider visibility and authenticity. Indexing of journals in reputed databases is one of the significant quality indicators.

The research activities have been accelerated in the recent past as approximately 40 % of the documents on orthodontic by Arab countries were published in the first 15 years, whereas the radical growth of literature (60 %) was observed in the last five years (2017–2021). Alfadley et al. [19] discussed the potential reasons for the drastic growth in scientific publications. The increasing number of dental institutions not only in Saudi Arabia but all across the Arab League Nations, cultivating collaborative research culture at national and international levels and more allocation of research and development funds [19].

Saudi Arabia has been emerging as a hub of research activities and scholarly publications in the Arab League Nations. A 2015 study reported that approximately 1,24,000 Saudi students were enrolled in different higher education programs in the 500 universities in the world [20]. The current study discloses that about 42 % of the Arab League Nations and 2.08 % of the global orthodontic research was contributed by Saudi Arabia. In the line of this other studies also reported similar findings, Saudi Arabia stood in 9th rank in dental research amongst the 240 countries of the world and its contribution was 2.47 % of global dental research [19]. In endodontic research, Saudi Arabian authors contributed 2.26 % of the global research [21]. As the number of dental colleges is increasing, similarly the quantity and quality of dental practitioners and researchers are also increasing. Scholarly activities play a substantial role in the promotion and recognition of authors and institutions. Publications opportunities have been increased due to the advancement of information communication technologies. Research collaboration prospects have been enhanced as a number of dentists belonging to various the Arab countries started serving and enrolling in higher education programs in the reputed universities of the world and they not only collaborated with their supervisors, colleagues and but also with native dental friends [17]. In a contemporary competitive environment, every country and even aspiring institutions are concerned about their ranking so various Arab countries offers lucrative incentives and financial grants for the publication of high-quality research [2].

About 87 % of the documents have been collaboration studies and 13 % were single-author studies. Collaborative studies gained slightly more citations as compared to solo authorship. The three-author pattern was found the most preferred but documents contributed by six-author pattern gained the highest citation impact. The ratio of authors per document was found 2.7 during the first interval (2002–2006) and it reached 4.10 authors per document in the last interval (2017–2021), this shows that the collaborative research activities increased with the passage of time. Ahmed et al. [2] reported that Egypt and Saudi Arabia had 86 % and 87 % collaborative studies in the Arab League Nations from 1980 to 2020, while Bahrain had 40 % of documents written by single-author pattern. In the line with these findings, a ten-year bibliometric study on Saudi Endodontic Journal endorsed that three-author pattern was the most frequent authorship pattern and 88 % were collaborative studies [19].

Most documents were written as articles (86.32 %) followed by reviews (8.47 %) but the citation analysis stated that reviews gained an average of 14.12 citations per review and articles gained 8.98 citations per article. Haq and Alfouzan also find parallel results that review papers were cited more as compared to articles in dental research produced by Saudi Arabia [1].

Approximately 42 % of the research in orthodontics was published in the top 15 journals and expect *International Medical Journal*, all journals have CiteScore of more than one. *European Journal of Orthodontics* has CiteScore 5.0 with second most-highest citation impact. The highest number of documents were published in *AJODO*, subsequently, these documents also gained the maximum citation impact. About 23 % of the documents were published in top-4 journals and every journal has more than 100 documents each. Previous studies endorsed that *AJODO*, has been the top preference by the orthodontics researchers [22–25].

The highest number of research collaborations was found with the authors of the United States and United Kingdom. The prevalence of this collaborative trend can be attributed to the fact that most Arab students are pursuing higher education in these countries. El-Rassi et al. [26] examined the medical research output in the Arab World from 2007 to 2018 and reported that 59 % of the Arab research indexed in Web of Science, involved international collaboration. The highest collaboration (29 %) was involved with the European Union and followed by the United States and Canada (19 %) [26].

The bibliometric indicators illustrate that overall a growing inclination for orthodontic publications in the Arab League Nations but the majority of the Arab countries demonstrated low productivity as only top-six countries contributed more than 100 documents each, and the top three countries produced more than two-thirds of the documents. There is a need to collaborate, educate and intellectually support low-income Arab countries. Saudi Arabia, Egypt and UAE can initiate scholarship programs in allied health sciences and dentistry for low-income Arab countries. The quality of health, prosperity and sustainable development of this region would strengthen linkage among them.

The data-set of the present study is limited to the Scopus indexed documents. Future studies can be combined the data-set retrieved from Web of Science, PubMed and Scopus to analyze the bigger intellectual landscape of Arab countries. The present research did not measure research productivity by institutions and the role of the author as principal or corresponding authors in the Arab World. Future studies can perform an in-depth analysis on these bibliometric characteristics. We only measured the citation metric of various bibliometric parameters of orthodontic research and did not examine the ratio of self-citations of authors, institutions, countries, and journals. A future study is required to evaluate the self-citation behavior.

There is a need to create a regional database that collects, organizes and disseminates the research contribution of Arab countries in English, Arabic, French and other languages. The medium of teaching in dental universities in Algeria and Tunisia is French. Out of 24 universities in Syria, 21 universities used Arabic language for teaching [17]. In present study, majority of documents contributed by the Arab countries were in English language but they also contributed some documents in French (n = 91), German (n = 5), Croatian (n = 3) and one paper in Italian language. All the reputed databases don't provide coverage of scholarly literature published in the

Arabic language. Regional database of Arab could provide more coverage of scholarly and scientific literature produced in this region.

5. Conclusions

The orthodontic research productivity of Arab League Nations has enhanced over the past 20 years and Saudi Arabia emerged as the most prolific country. Most of the Arab League Nations are still lagging behind the rest of the Arab League Nations. This study indicates that research productivity is highly reliant on availability of resources, research incubators and innovative environment. Research productivity in our example was independent of demographical factors. It is necessary to revisit the higher education system and research productivity at these countries. Overall, constructive evolution with international research collaboration was found and it is a need to continue this momentum as well as to improve the quality of the publications. This study shed the light on the potential of future global collaboration in multi-centered randomized clinical trial inclusive of multi-ethnicity as it highlighted the Arab League Nations as promising research partners.

Ethics approval and consent to participate

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Data availability

Data included in article/supplementary material/referenced in article.

CRedit authorship contribution statement

Mohammed Adel Awawdeh: Supervision, Project administration, Methodology, Conceptualization. **Ikram Ul Haq:** Writing – original draft, Software, Methodology, Formal analysis. **Nora Alhazmi:** Writing – review & editing, Visualization, Validation. **Ali S. Aljhani:** Writing – review & editing, Validation. **Mohammad Younis Hajeer:** Writing – review & editing, Validation. **Abdulilah Mohammed Babtain:** Writing – original draft, Investigation, Data curation. **Abdullah Mishan Alanzi:** Writing – original draft, Investigation, Data curation. **Naif Mohammed Almutairi:** Writing – original draft, Investigation, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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