PubMed-Indexed Dental Publications from Iran: A Scientometric Study

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Abstract

Objectives: Scientometric methods and the resulting citations have been applied to investigate the scientific performance of a nation. The present study was designed to collect the statistical information of dental articles by Iranian authors published in PubMed.

Materials and Methods: We searched the PubMed database for dental articles of Iranian authors until June 31, 2015. All abstracts were manually reviewed in order to exclude false retrievals. The number of articles per dental subspecialties, distribution of research designs, Scopus/Google Scholar citation of each article, number of authors and affiliation of the first/corresponding author were extracted and transferred to Microsoft Excel. The data were further analyzed to illustrate the related scientometric indicators.

Results: A total of 3,835 articles were retrieved according to the selection criteria. The number of PubMed-indexed publications between 2008 and 2015 showed a seven-fold increase. The majority of articles were written by four authors (24.56%). Systematic reviews and clinical trials constituted 9.20% of all publications. The number and percentage of articles with ≥4 citations from Google Scholar (n=2024; 52.78%) were higher than those from Scopus (n=1015; 26.47%). According to affiliated departments of the first authors, the top three dental subspecialties with the highest number of publications belonged to endodontics (19.82%), orthodontics (11.13%) and oral and maxillofacial surgery (10.33%). Moreover, the majority of articles originated from Shahid Beheshti - (14.47%), Tehran- (13.72%) and Mashhad - (12.28%) University of Medical Sciences.

Conclusions: Analysis of PubMed-indexed dental publications originating from Iran revealed a growing trend in the recent years.

Keywords: Bibliometrics; Iran; Publications

INTRODUCTION

Iran is home to one of the world's oldest civilizations in Southern and Western Asia. The 18th-largest country in the world in terms of area at 1,648,195 km², Iran has a population of around 79 million [1].

While the publication of scientific results is the main aim of research activity, scientometric methods (the study of research output in the form of scientific articles) and the resulting citations have been applied to investigate the scientific performance of a nation [2]. Universal databases, which are being used in such studies include the Thomson-Reuter Institute of Scientific Information/Web of Science database (ISI), PubMed, Scopus and Google Scholar [3,4]. PubMed, as a trouble-free, fast and open database, has indexed ≥5,650 journals since 1950 and has become one of the most reliable web based resources for clinicians as well as researchers in biomedical/
Biomedical/Dental research as the leading science has had great impact on researchers, health professionals and policy makers; these sciences weigh heavily on the measurements of national competitiveness [6]. Over the past 30 years, Iran has invested profoundly on its research infrastructure in many fields of science and technology i.e. medicine/dentistry/pharmacology, space sciences, nanotechnology, biotechnology and nuclear technology; in the new millennium, Iran has experienced a remarkable growth in the field of biomedical/dental research [7]. While less than 1% of Iran’s Gross Domestic Product (GDP) was allocated to research until 2011, there is a national plan for increasing this to 3% by 2016.

The objective of the present study was to investigate the quantity as well as the quality of PubMed-indexed published dental articles originated from Iran. The number of articles and contributors, patterns of research designs, most selected scientific journals for each subspecialty, research output of various scientific groups/universities, characteristics of frequently cited papers and Scopus/Google Scholar citation for each subspecialty were evaluated.

MATERIALS AND METHODS

In order to access published articles by the Iranian authors in PubMed-indexed journals, a limited search of affiliations was conducted using the following keywords: dental OR endodont* OR orthodont* OR periodont* OR pedodont* OR prosthodont* OR oral OR dentistry. The next step was to search without limitations using the words Iran OR Iranian. Finally, using advanced search, the above results were combined and the articles that had been published by June 31, 2015 were extracted. The abstracts (and full texts where necessary) were reviewed, and articles in which at least one Iranian author from an Iranian university or institute had contributed were selected and then analyzed.

The following data were extracted from each article and transferred to Microsoft Excel: Year of publication, field of study, name of journal, affiliation of the first/corresponding author, number of authors, Scopus/Google Scholar citation and study design. The field of study of each article was determined twice, i.e. according to I) affiliated department of the first author and II) that of corresponding author. In case any of these were not available or were not relevant to the fields of dentistry, title and content of the article were used. Hence, all data that were affected by this grouping were also presented twice. No statistical analyses were performed.

RESULTS

From a total of 1,257,305 dental publications, 3,835 publications were included according to the selection criteria. Overall, the most frequent fields of study were endodontics and orthodontics, whilst the least frequent fields of study were dental materials, community oral health (COH) and oral radiology (Fig. 1A). It is worthy of mention that 124 and 262 studies were grouped as “unknown” considering the affiliation of the first author and corresponding author for grouping, respectively. This group consisted of studies that could not be categorized into one specific field (of study) based on the previously mentioned criteria. The aforementioned group was not shown in any of the relevant Figures or Tables.

The number of publications in each field was categorized according to the year of publication in the past 10 years (Table 1). The average growth in the number of dental publications indicated a positive trend; the results in relation to the number of dental publications in the field of endodontics indicated a decline from 2010 to 2011 (Fig. 1B). The publications in each field were presented according to the title of journal, and Table 2 shows the three journals with the highest number of publications in each field. The
Impact Factor (IF) of the journals in 2014 is also presented; “Iranian Endodontic Journal” and “Journal of Endodontics” had the highest number of articles and IF, respectively (Table 2). Overall, the most frequent study design belonged to the ‘others’ group, which included letter to editor, epidemiological studies, descriptive studies, diagnostic accuracy studies, the introduction of a new method, health education, hypothesis and cross sectional studies; meta-analysis and systematic review studies were the least frequent study designs (Fig. 1C).

Table 3 presents the three articles with the highest number of citations according to Google Scholar in each subspecialty. The highest number of citations was in the field of endodontics. Although no statistical analyses were performed. Table 4 shows the top 10 universities with the highest number of dental publications and their three most active scientific groups. The universities of Tehran, Shahid Beheshti and Mashhad had produced the highest number of dental publications amongst all medical universities in Iran.

The number of authors varied from one to 16; the majority of articles were written by four authors (Table 5). The number and percentage of citations of Iranian dental articles in Google Scholar and Scopus are presented in Table 6; Figure 1D shows a sharply increasing trend for
articles with no previous citations in Google Scholar and Scopus.

DISCUSSION

Scientometric markers are progressively used to assess the patterns of research performed by scientists/researchers, universities/institutes and countries [8]. Objective scientometric indices have been specified for such assessments during the previous six to seven decades. The application of scientometric techniques/rankings based on various indices has led to more inter-regional competition among the Europe and the United States, west and east and the forthcoming Asian countries [2,9]. Our results demonstrated that the number of PubMed-indexed dental publications originating from Iran had an increasing trend in the recent years. The past three decades have been marked by near constant tensions in the Middle East, including the imposed Iraq-Iran war, after which Iraq’s scientific system progressively collapsed and not until recently has it displayed any signs of recovery.

In contrast, Iran has displayed one of the fastest growth rates in scientific production that the world has witnessed [10]. Iran has progressed successfully in its agenda to improve
Table 2: Three most selected Journals by scientific groups

| Subspecialty                  | Authors               |  |
|-----------------------------|-----------------------|---|
| Endodontics                | F 1 Iran Endod J 262  |
|                            | C 2 J Endod 256       |
| Orthodontics               | F 2 J Dent (Tehran) 47|
|                            | C 3 Dent Res J (Isfahan) 48 |
| Oral & Maxillofacial Surgery | F 3 J Oral Maxillofac Surg 76  |
|                            | C 4 J Craniofac Surg 72 |
| Operative Dentistry        | F 4 J Contemp Dent Pract 37 |
|                            | C 5 J Dent Res Dent Clin Dent Prospects 37 |
| Prosthodontics             | F 6 J Dent (Tehran) 37 |
|                            | C 7 J Prosthet Dent 28 |
| Pedodontics                | F 8 J Dent Res Dent Clin Dent Prospects 39 |
|                            | C 9 Dent Res J (Isfahan) 30 |
| Periodontics               | F 10 J Dent (Tehran) 34 |
|                            | C 11 J Dent Res J (Isfahan) 31 |
| Oral Medicine              | F 12 J Dent Res Dent Clin Dent Prospects 46 |
|                            | C 13 Dent Res J (Isfahan) 41 |
| Oral Pathology             | F 14 J Dent Res J (Isfahan) 28 |
|                            | C 15 Dent Clin Dent Prospects 28 |
| Oral Radiology             | F 16 J Dent Res J (Isfahan) 28 |
|                            | C 17 Dent Clin Dent Prospects 28 |
| Community Oral Health      | F 18 J Dent (Tehran) 28 |
|                            | C 19 J Dent (Tehran) 28 |
| Dental Materials           | F 20 J Endod 3 3.37 |
|                            | C 21 Int Endod J 4 2.97 |

C= corresponding author, F= First author; R=Rank; No= Number of published articles; IF= Journal’s impact factor (2014)

its (inter) national profile in biomedical research by continuously increasing the quantity/quality of publications in peer reviewed scientific PubMed-indexed journals [7,11]. A recent study
Table 3: Three most cited articles in Google Scholar (GS) according to related scientific group

| Authors | R | First Ranked Article                                                                 | GS | S | Second Ranked Article                              | GS | S | Third Ranked Article                           | GS | S |
|---------|---|--------------------------------------------------------------------------------------|----|---|----------------------------------------------------|----|---|------------------------------------------------|----|---|
| Endodontics |  F | Mineral trioxide aggregate: a comprehensive literature review--Part I: chemical, physical, and antibacterial properties. | 502 | 269 | Oral pyogenic granuloma: a review. | 329 | 111 | Human saliva penetration of coronally unsealed obturated root canals. | 322 | 146 |
| Orthodontics |  F | Effects of low-level He-Ne laser irradiation on the gene expression of IL-1beta, TNF alpha, IFN-gamma, TGF-beta, bFGF, and PDGF in rat's gingiva. | 145 | 84 | Alveolar bone resorption and the center of resistance modification (3-D analysis by means of the finite element method). | 108 | 51 | Oral health in Iran. | 104 | 36 |
| Oral & Maxillofacial Surgery |  F | Maxillofacial fractures in Hamedan province, Iran: a retrospective study (1987-2001). | 142 | 53 | Marrow-derived mesenchymal stem cells-directed bone regeneration in the dog mandible: a comparison between biphasic calcium phosphate and natural bone mineral. | 103 | 51 | Salivary gland tumors in an Iranian population: a retrospective study of 130 cases. | 98 | 41 |
| Periodontics |  F | Sinus augmentation using human mesenchymal stem cells loaded into a beta-tricalcium phosphate/hydroxyapatite scaffold. | 126 | 84 | Treatment of severe physiologic gingival pigmentation with free gingival autograft. | 111 | 36 | Comparative evaluation of the effects of Nd:YAG and Er:YAG laser in dentin hypersensitivity treatment. | 109 | 61 |
| C |  | Treatment of severe physiologic gingival pigmentation with free gingival autograft. | 111 | 36 | Effects of periodontal treatment phase I on birth term and birth weight. | 76 | 39 | Hyperlipidemia in patients with periodontitis. | 67 | 30 |
| Prosthodontics |  F | An assessment of crown-to-root ratios with short sintered porous-surfaced implants supporting prostheses in partially edentulous patients. | 119 | 53 | Evaluation of "golden proportion" in individuals with an esthetic smile. | 112 | 39 | Flapless implant surgery: review of the literature and report of 2 cases with computer-guided surgical approach. | 60 | 34 |
| C |  | Evaluation of "golden proportion" in individuals with an esthetic smile. | 112 | 39 | Flapless implant surgery: review of the literature and report of 2 cases with computer-guided surgical approach. | 60 | 34 | Computer-assisted implantology: historical background and potential outcomes-a review. | 51 | 24 |

C= corresponding author, F= First author; R=Rank; S=SCOPUS
Table 3: Continued

| Authors | R | First Ranked Article | GS | S | Second Ranked Article | GS | S | Third Ranked Article | GS | S |
|---------|---|----------------------|----|---|-----------------------|----|---|----------------------|----|---|
| F       | 6 | Comparison of zinc oxide and eugenol, and Vitapex for root canal treatment of necrotic primary teeth. | 103 | 44 | Induced in vitro differentiation of neural-like cells from human exfoliated deciduous teeth-derived stem cells. | 67 | 35 | Diagnosis and management of supernumerary (mesiodens): a review of the literature. | 65 | *** |
| C       | 7 | | | | Comparison of mineral trioxide aggregate and formocresol as pulp medicaments for pulpotomies in primary molars. | 63 | 26 | An epidemiological survey of the time and sequence of eruption of permanent teeth in 4-15-year-olds in Tehran, Iran. | 49 | 20 |
| F       | 7 | Inhibitory activity of garlic (Allium sativum) extract on multidrug-resistant Streptococcus mutans. | 94 | 27 | The effect of topical application of pure honey on radiation-induced mucositis: a randomized clinical trial. | 84 | 51 | Hepatitis B virus infection in dentistry: a forgotten topic. | 80 | 37 |
| C       | 8 | | | | Correlation between clinical and histopathologic diagnoses of oral lichen planus based on modified WHO diagnostic criteria. | 79 | 46 | | |
| F       | 8 | The effect of ceramic and porous fillers on the mechanical properties of experimental dental composites. | 89 | 53 | The effect of hydrogel and solution of sodium ascorbate on bond strength in bleached enamel. | 82 | 32 | Microleakage of direct and indirect composite restorations with three dentin bonding agents. | 61 | 21 |
| C       | 9 | | | | | | | | |
| F       | 9 | Prevalence of dental developmental anomalies: a radiographic study. | 88 | 33 | Radiographic evaluation of the mental foramen in a selected Iranian population. | 64 | 23 | Dental age assessment among Iranian children aged 6-13 years using the Demirjian method. | 54 | 22 |
| C       | 10 | | | | | | | | |
| F       | 10 | Feeding habits as determinants of early childhood caries in a population where prolonged breastfeeding is the norm. | 76 | 35 | Early childhood caries and dental plaque among 1-3-year-olds in Tehran, Iran. | 62 | 19 | Survival after diagnosis of cancer of the oral cavity. | 57 | 39 |
| C       | 11 | | | | Diagnosis and management of supernumerary (mesiodens): a review of the literature. | 65 | - | Early childhood caries and dental plaque among 1-3-year-olds in Tehran, Iran. | 62 | 19 |

C= corresponding author, F= First author; R=Rank; S=SCOPUS; ***= Not indexed in Scopus
reported that Iran performed higher than the expected level in six out of the 62 subfields of Life Sciences; these include andrology, dentistry, oral surgery and medicine, ecology, entomology, mycology and orthopedics. In addition, andrology is the sole subfield in Life Sciences in which Iran has performed above the global average [12]. The growth rates in the subfields of dentistry, oral surgery and medicine are in the second place and may pass the global trend in the near future. The positive trend in dental research output from Iran can be attributed to the focus on research by policy-makers, a national commitment by research policy change and a drastic rise in research resources. The research budget allocated to the health sector doubled from 1997 to 2005, and there was a significant growth in the number of health/medical/dental researchers. The number of dental research centers in the country increased from one in 1995 to ~20 in 2012. Such achievements were a result of a national movement in Iran to develop research in a broad-spectrum.

Research productivity is the amount of research performed by scientists within a certain time span [13]. Research productivity evaluation is a critical issue because it serves to verify the existing knowledge in an institution, determine the efficiency in addition to the quality of their research and discover less frequently researched subjects; this evaluation provides a basis for promotion decisions, funding allocations and educational reform; it lately serves as an indicator of university quality as well [14]. Our results revealed that endodontic researchers had the highest number of publications, particularly in the “Iranian Endodontic Journal”. The most frequently cited articles also belonged to the field of endodontics. Furthermore, endodontic groups were the most frequently rated active research groups in the top ten dental schools. It has been demonstrated that endodontic research productivity in Iran is positive and is favorable in comparison to other regional countries [9,15,16], which is in accord with the current results. Our results demonstrated that 3.73% of the articles were written by one author, while the majority of them (~46%) were written by three or
Asgary et al  

 PubMed-Indexed Dental Publications from Iran

Table 4: Top ten dental schools and top three disciplines that had the highest scientific paper production.

| Top Ten Dental Schools in Iran | Authors | R  | N   | Top Three disciplines (Number of Articles) | First Ranked | Second Ranked | Third Ranked |
|-------------------------------|---------|----|-----|------------------------------------------|--------------|---------------|--------------|
| Shahid Beheshti               | F 1     | 555| 131 | Oral Surgery                              | 75 Orthodontics | 64 Community Oral Health | 63 Endodontics |
|                              | C 2     | 494| 132 | Endodontics                               | 64 Community Oral Health | 54 Endodontics | 54 Endodontics |
|                              | F 2     | 526| 80  | Endodontics, Prosthodontics               | 80 Orthodontics | 67 Endodontics | 62 Prosthodontics |
| Tehran                       | C 1     | 508| 84  | Endodontics                               | 72 Endodontics | 62 Oral Surgery | 59 Oral Surgery |
| Mashhad                      | F 3     | 471| 103 | Endodontics, Prosthodontics               | 82 Endodontics | 58 Oral Surgery | 56 Oral Pathology |
|                              | C 4     | 461| 123 | Endodontics                               | 89 Oral Pathology | 57 Oral Surgery | 56 Oral Pathology |
| Isfahan                      | F 4     | 379| 67  | Prosthodontics                            | 61 Operative Dentistry | 59 Endodontics | 46 Endodontics |
|                              | C 5     | 359| 62  | Operative Dentistry                      | 59 Endodontics | 41 Endodontics | 41 Endodontics |
| Shiraz                       | F 6     | 353| 56  | Endodontics                               | 53 Orthodontics | 52 Dental Material | 39 Operative Dentistry |
|                              | C 7     | 341| 53  | Orthodontics                              | 52 Oral Pathology | 52 Pedodontics | 38 Oral Pathology |
|                              | F 8     | 330| 82  | Endodontics                               | 56 Oral Pathology | 49 Pedodontics, Periodontics, Prosthodontics | 34 Operative Dentistry |
| Tabriz                       | C 9     | 337| 75  | Endodontics                               | 62 Operative Dentistry | 49 Pedodontics, Periodontics, Prosthodontics | 35 Operative Dentistry |
| Azad (Tehran)                | F 10    | 231| 50  | Endodontics                               | 44 Orthodontics | 40 Oral Surgery | 38 Dental Material |
|                              | C 11    | 207| 49  | Orthodontics                              | 38 Oral Pathology | 38 Endodontics | 26 Oral Surgery |
| Hamadan                      | F 12    | 167| 45  | Endodontics                               | 35 Operative Dentistry, Oral Surgery | 26 Operative Dentistry | 22 Operative Dentistry |
|                              | C 13    | 153| 38  | Endodontics                               | 24 Operative Dentistry | 22 Operative Dentistry | 22 Operative Dentistry |
| Kerman                       | F 14    | 132| 50  | Endodontics                               | 30 Oral Medicine | 14 Pedodontics | 14 Oral Medicine |
|                              | C 15    | 128| 56  | Endodontics                               | 31 Oral Medicine | 10 Pedodontics | 10 Dental Material |
| Yazd                         | F 16    | 131| 31  | Endodontics                               | 57 Oral Radiology | 20 Ortophodontics | 20 Oral Radiology |
|                              | C 17    | 124| 30  | Endodontics                               | 30 Ortophodontics | 16 Pedodontics | 16 Oral Radiology |

C= corresponding author, F= First author; R=Rank; N= Total Number of Articles

Randomized clinical trials, systematic reviews and meta-analyses provide the highest level of evidence [17,18]. They have a remarkable role in scientific grading thus being useful for decision making, treatment planning, practical guidelines and health policy decisions [19]. Our results similar to previously reported results showed that four authors. Iranian researchers in the fields of dentistry, oral surgery and medicine have collaborated well with each other domestically. This may be due to several factors, including the nature of their research, availability of the Internet and e-mail correspondence as well as communication between graduate students and their advisers. In relation to this, researchers should be motivated for international collaborations.

Table 5: Number and percentage of authors per article

| Number of Author(s) | Number of Articles | Percent |
|---------------------|--------------------|---------|
| 1                   | 143                | 3.73    |
| 2                   | 498                | 12.99   |
| 3                   | 812                | 21.17   |
| 4                   | 942                | 24.56   |
| 5                   | 700                | 18.25   |
| 6                   | 413                | 10.77   |
| 7                   | 198                | 5.16    |
| 8                   | 81                 | 2.11    |
| 9                   | 32                 | 0.83    |
| 10                  | 7                  | 0.18    |
| 11                  | 8                  | 0.21    |
| 16                  | 1                  | 0.03    |
| Total               | 3835               | 100.00  |
Table 6: Number and percentage of citations of Iranian dental papers in Google Scholar and Scopus

| Citations | GS*   | Percentage | S**   | Percentage |
|-----------|-------|------------|-------|------------|
| 0         | 726   | 18.93%     | 1954  | 50.95%     |
| 1         | 453   | 11.81%     | 370   | 9.65%      |
| 2         | 341   | 8.89%      | 269   | 7.01%      |
| 3         | 291   | 7.59%      | 227   | 5.92%      |
| 4         | 226   | 5.89%      | 163   | 4.25%      |
| 5         | 208   | 5.42%      | 106   | 2.76%      |
| 6         | 158   | 4.12%      | 103   | 2.69%      |
| 7         | 158   | 4.12%      | 79    | 2.06%      |
| 8-10      | 353   | 9.20%      | 169   | 4.41%      |
| 11-15     | 283   | 7.38%      | 148   | 3.86%      |
| 16-20     | 170   | 4.43%      | 80    | 2.09%      |
| 21-30     | 192   | 5.01%      | 82    | 2.14%      |
| >30       | 276   | 7.20%      | 85    | 2.22%      |
| Total     | 3835  | 100.00%    | 3835  | 100.00%    |

*= Number of citation in Google Scholar; **= Number of citation in Scopus

CONCLUSION
Considering the results of Iranian PubMed-indexed publication analysis in the field of dentistry, Iranian dental research output was promising and showed an increasing trend in the recent years.

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