Original Article

Contribution of Indian dental research to the Scimago™ Database during 1996-2007: A preliminary report

Abstract

The objective of this study was to assess the contribution trend of Indian dental research to the scientific publication during 1996–2007. Articles and reviews in the category of dentistry published from 1996 to 2007 were accessed through the Scimago™ portal from the Scopus database. The data were analyzed quantitatively and qualitatively. India had published 693 articles during the period, with a contribution of 1.21% to the global dental research. India had published an average of 57.75 dental research articles per year. In 1996, India had contributed only 2% to all Asian Dental research output, while in 2007, it was 17.32%. Of the entire Indian biomedical field, dentistry has achieved a 26.13-times growth in 2007 in terms of the volume of the published literature as compared with its status in 1996. Similarly, dental publication from India drastically rose in 2007 by Indians (26.13) as compared with their dental publication volume in 1996.

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Introduction

India has a long and distinguished history as a seat of learning, knowledge and innovation. Presently, India is predicted to play a huge part and a vital source of influence on the future. Although, in the modern era, science and technology have been central to India's development efforts, recent years have seen a growing realization among scholars, policymakers and other observers that India lags behind other key countries in research investment and output from all areas of science.[1]

In the recent past two decades, India has failed to realize its undoubted potential as a home for world-class research. During the 1980s and the early 1990s, the output of India's research base was almost static while other countries grew rapidly, particularly other countries in Asia. There are signs that there is now a change in this trajectory that will bring India up to the level where it can begin to realize its potential, to the benefit of its own population and economy as well as contributing to global knowledge networks. The latest 5-year plan, covering the years 2007–2012, includes a four-fold increase for education over the previous plan. Overall, as *Nature* reported earlier in 2009, the Indian government spending on science research currently accounts for roughly 0.9% of the gross domestic product; but, by 2012, the figure is expected to rise to 1.2%. In spite of these measures, India lacks the availability of qualified researchers to keep pace with the increased funding. A report from India's National Council of Applied Economic Research reported that the proportion of the population holding graduate degrees increased from 2.4% of the population (20.5 million) in 1991 to 4.5% (48.7 million) in 2005. Increase in government support of science, and the subsequent improvement of existing institutions or the establishment of new ones, is beginning to result in the return of expatriate researchers. From an essentially flat line between 1998 and 2000, the quantity of publication outputs begins rising steadily, increasing from roughly 16,500 papers in 1998 to nearly 30,000 in 2007. In a recent 5-year period, India produced roughly 126,000 papers, constituting 2.75% of the world's papers published in journals indexed by Thomson Reuters. India's portfolio is markedly balanced between the life sciences and the physical sciences.[1,2]

Indian Medical books existed since the period of Sushrutha

T. Rooban, P. D. Madan Kumar[1], S. Ramachandran

Departments of Oral & Maxillofacial Pathology and [1]Public Health Dentistry, Ragas Dental College and Hospital, 2/102 East Coast Road, Uthandi, Chennai - 600 119, India

Address for correspondence:
Dr. P. D. Madan Kumar,
Department of Public Health Dentistry, Ragas Dental College and Hospital, 2/102 East Coast Road, Uthandi, Chennai - 600 119, India.
E-mail: madankumar21@yahoo.co.in

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and Charaka's samithas, who were said to have lived during the 4th and 5th century BC. Medical articles started publishing, in the present form, from the year 1790, and as much as two Indian articles appeared in the second volume of *Asiatick Researches* published in that year. It was interesting to know that the article entitled, "On the cure of elephantiasis," was by an Indian called At'har Ali.[3] Incidentally, this was the first article on a scientific subject by an Indian published in *Asiatick Researches*. The second article was on the cure of persons bitten by snakes, by John Williams. After *Asiatick Researches*, the second learned journal to appear from India was the *Transactions of the Medical and Physical Society* of Calcutta. This journal, started in 1825, continued till 1845, producing nine volumes.[3] Since then, numerous medical journals enfolding all types of organized medicine started publishing from India. The Indian dental history is more than 100 years old, with the first dental college at Lahore in the subcontinent and, subsequently, in Kolkotta from 1920.[4] Since then, dentistry in India has grown leaps and bounds. India ranked 26th in terms of the number of peer-reviewed published manuscripts in the period 1999–2003 using the ISI database approach (0.66% of all contributions).[5]

The analysis of scientific research in the biomedical field and, particularly dentistry, is a complex process and no satisfactory methodology has been developed or identified that fully satisfies the needs of researchers, institutions, administrators and policy makers. The analysis of publications is one of the most widespread approaches but has also drawn the most criticism. The qualitative evaluation of scientific publications as the direct output of research is usually performed in one of two ways: by the number of citations or by the Impact Factor (IF) published by the Institute for Scientific Information, ISI (Philadelphia, PA, USA).[5,6]

SCImago™ is a web portal that includes the journal and scientific indicators developed from the information contained in the scopus database of all scientific domains that can be retrieved, assessed and analyzed. The site is Consejo Superior de investigaciones Cientifices, University of Granada, Extremadura, Carlos III (Madrid) and Alcala de Henares.[7] The SCImago Journal Rank (SJR) indicator assesses the quality of scientific journals, applying the widely accepted google PageRank algorithm on the Scopus database.[6,7]

Analysis of research outcomes may help indicate the development of scientific and technological policies in dentistry and will be of special relevance for emerging countries such as India.[5] The present study was designed to depict the dimension of Indian dental research by recording and analyzing scientific production in this field, with an emphasis on the Indian dental publication scenario using Scimago.

Materials and Methods

Data pertaining to dental publications from India were retrieved from the SCImago Journal (www.scimagojr.com.[7]) between November 26 and 28, 2009. The details of all Asian countries (that has published at least one article) during the study period were also retrieved. All the details collected were entered and analyzed in the Microsoft office–Excel Package (2007). All frequencies and mean number of articles published are presented, and a trend analysis was performed for the number of articles that would be published by Indians till 2050.

Results and Discussion

There were 57,112 dental research articles published by 126 countries across the globe in the 12-year period. India had published 693 articles during the period, with a contribution of 1.21% to the global dental research. India had published an average of 57.75±75.05 dental research articles per year.

Figure 1 depicts the contributions to dental research by 11 top Asian countries. In 1996, India had contributed only 2% to all the Asian dental research output. In 2007, it rose to 17.32% of all the Asian dental research output. In the early 21st century, India witnessed an increase if the number of dental colleges and, thereby, an increase in the qualified dental work force. This is reflected by a relative increase in the number of published dental literature as observed in Figure 1. During the same period, none of the other Indian biomedical fields had published as much as the Dental field in India. This is observed in Table 1. Figures 2-3 and Table 1 reveal the relative growth of dental literature in India. None of the other biomedical fields has contributed as much as dentistry.

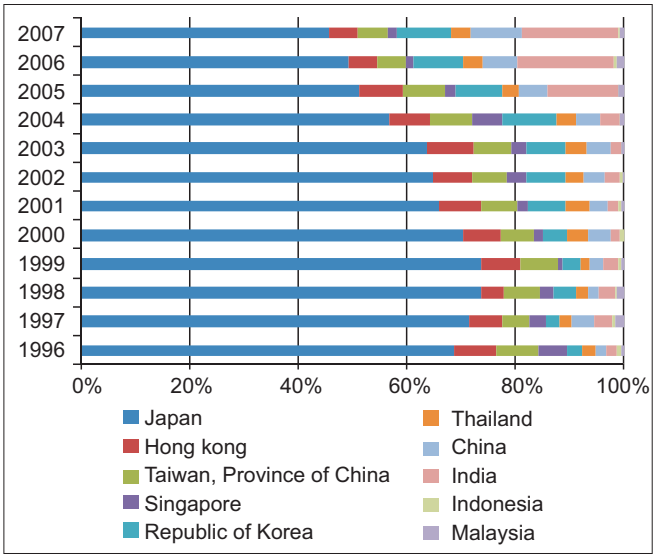


Figure 1: Year-wise showing dental research output contribution of Asian Countries

Table 1: Contribution to the global medical literature from India during the study period (1996–2007)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Biochemistry, genetics, molecular biology	2178	2276	2257	2338	2111	2372	2732	3308	3184	4244	4969	5816
Dentistry	8	13	15	13	9	14	20	17	33	138	204	209
Health professions	33	33	33	35	44	39	35	45	65	97	97	123
Immunology and microbiology	614	589	598	645	669	718	877	1034	1100	1251	1389	1741
Medicine	2743	3052	3331	3608	3749	4051	4669	5808	6089	6946	7561	8023
Neuroscience	82	122	129	104	113	125	122	181	124	167	279	312
Nursing	10	18	13	19	26	20	44	35	30	64	81	119
Pharmacology, toxicology and pharmaceutics	496	582	599	715	674	710	748	906	970	1218	1759	1905
Psychology	32	27	27	25	29	29	38	42	44	39	56	68
Veterinary sciences	499	601	813	609	626	703	790	819	830	759	821	951

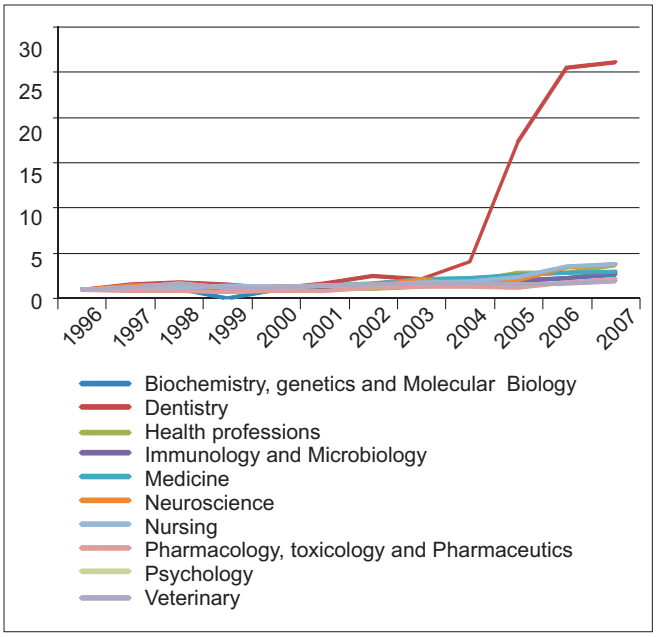


Figure 2: Growth of biomedical publication in India as compared with its state in 1996

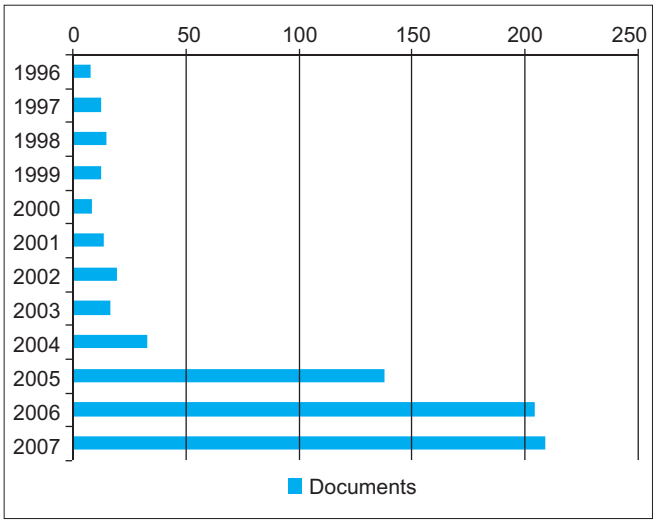


Figure 3: The number of dental research articles published by Indians during the study period

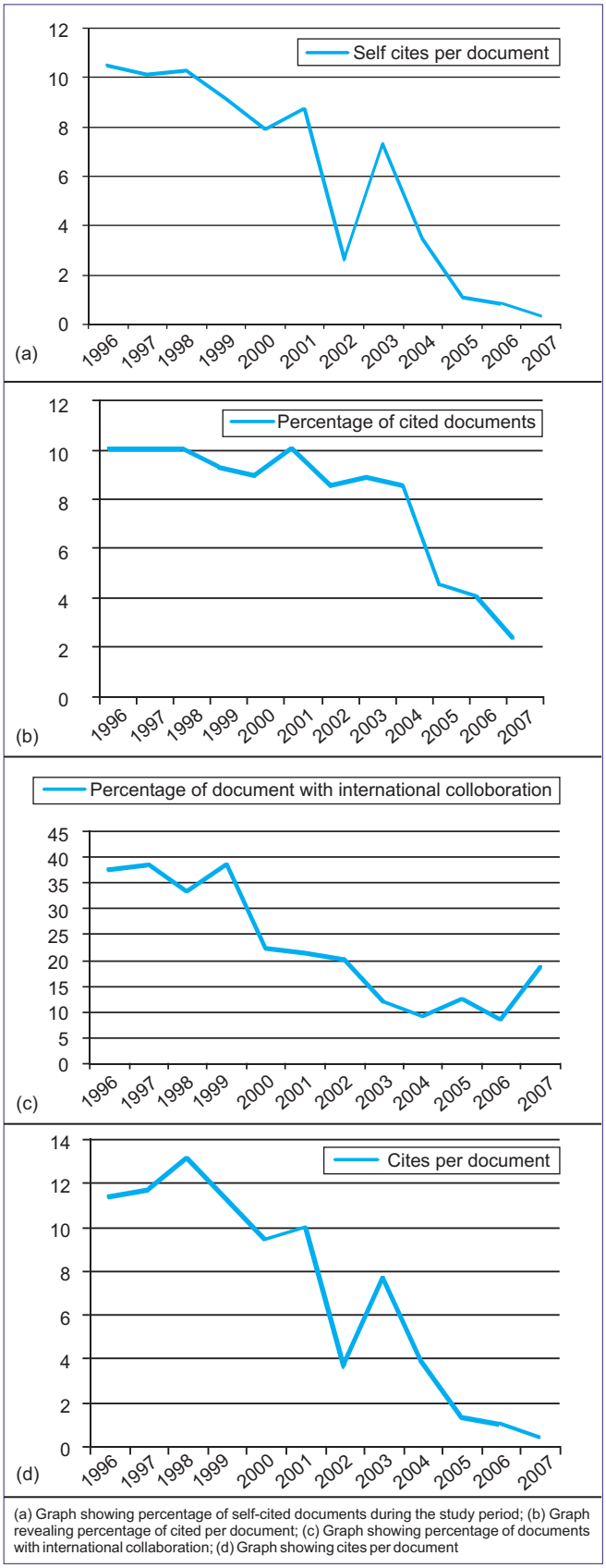
The reason for the increase in the quality and quantity of the Indian Dental literature during the study period could be due to the following reasons:

a. Increase in the quantity and quality of the Indian dental force.
b. Change in the policy of the Indian Dental academic circles.
c. Increased opportunities.
d. Increase in the number of journals published from India.
e. Increasing global presence of Indian diasporas who helped their Indian dental friends.
f. Increased government funding opportunities or a combination of all or some of these factors.

Figure 3 depicts the number of dental research articles published by Indians during the study period. Most of the Indian dental literature has been cited till 2002, whereas, afterwards, it has dropped to 22.97%. Similarly, the cites per Indian document peaked in 1998, and were at an all-time low in 2002. Self-citation per Indian document has been constantly low. In 1996, 37.5% of all Indian dental documents were written with international collaboration while in 2006, 8.33% of all Indian dental documents were with international collaboration.

Figure 4 depicts the number of citable publications from India as compared with the published documents during the study period. As the quanta of number of Indian dental documents are increasing, the focus is on the quality of these articles. As observed in Figure 4B, the percentage of cited documents was in the same range during 1996–2004, after which it has dropped lower. The reason could be an increasing tendency to publish isolated case reports or rare case series that often have poor citation records. To improve this situation, the Indian dental researcher should concentrate on publishing original research rather than case reports, which are more often cited and include current research topics than obsolete ones.

The number of average cites per Indian dental research work [Figure 4D] has climbed lower since 2002. This graph indicates



(a) Graph showing percentage of self-cited documents during the study period; (b) Graph revealing percentage of cited per document; (c) Graph showing percentage of documents with international collaboration; (d) Graph showing cites per document

Figure 4: Composite graph showing percentage of citation, cites per document, self-citation and international collaboration between the selected countries during the study period

that the Indians have published dental documents that have been cited 13 times in 1998 and 0.41 times in 2007. The comparison of citable documents as seen in Figures 4B and 5 indicates that not all documents that have been published have been cited at least once. Self-citation of documents [Figure 4A] has been lower among the Indian Dental researcher. The reason for this is that Indian dental researchers tend not to specialize in a few chosen fields, but the choice of the research topic is made by many other factors, including funding and lack of resources, besides personal interest.

International collaboration has been a hallmark of professional excellence, academic integrity and achievement.[2] Although the number of Indian dental papers published with international collaboration has increased in volume, the percentages have dropped. During the study period, Indian dental research papers published through international collaboration have halved [Figure 4C]. This trend could be due to the following:

a. Growing self-reliance by Indian Dental research,
b. Increase in case history publications,
c. Decrease in international collaborative works in India,
d. Role of Indian Dental Diaspora or
e. A combination of all the above.

As the volume of papers with international collaboration has risen, it is a fair judgment that the Indian Dental Research climate is favourable and has attracted more collaboration but, at the same time, publishing of many documents by Indians may have masked the effect of this vital information. With all its diversity, capacity and voluminous dental workforce, it is a surprise that, at present, India does not collaborate more as it had in the past. The collaborative network does now seem to be expanding, and it is appearing to expand eastwards (Japan, China), toward other new and emerging research economies and not to the traditional trans-Atlantic research axis. It is to be noted that in 2007, about a third of Japanese and half of Chinese dental research publications were internationally associated.

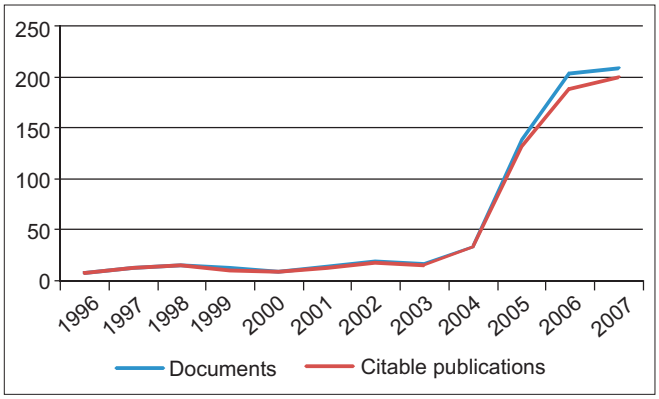


Figure 5: Number of dental-related publications and citable publications from India during 1996–2007

Figure 5 shows the estimated number of dental research documents published per year if proceeding at the 2002–2007 rates. On a linear trend, India is estimated to produce 356.66 articles per year in 2010, 1047.1 in 2025 and 2197.8 articles in 2050 [Figure 6]. At the present rate of publications, it can be assumed that India may take a couple of years to reach the volume of publications as produced by global leaders like USA, UK and Japan. It is to be noted that the Indian growth trajectory is much higher and steeper than them and, hence, within a short span of time, the Indian Dental research publication will surpass them. Similarly, in India, dentists have been aggressively pursuing research as compared with the other biomedical fields. Promotion of dental research among the young dentist and creating opportunities for research by inducting new grants, publication-based promotion and creating institutes similar to the National Institute of Dental and Craniofacial Research, USA, would stimulate the growth of Indian dental publication. At the present rate of growth trend, India is expected to make about 2200 published documents a year in 2050, as shown in Figure 6. Encouragement in any form will help this number to get even higher.

With the changing Indian dental academic scenario, emphasis has to be placed on original research collaborative works and more academicians should be encouraged to lead higher level projects with higher funding. Young dental surgeons should be encouraged to take dental research as their career along with their clinical practice. Current topics should be taken for research to increase their citations and collaborative efforts with multicenter studies should be encouraged. The need of the hour is higher quality manuscripts that are much sought after by the dental academics. Indian dental policies shall be best focused and should be interested in engaging with India's growing research base (in allied fields of biotechnology, nanotechnology, complementary medicine and molecular biology) and to take advantage of the opportunities for innovation that they are bound to create. In such an eventuality, the new geography of dental research may see not just a new leading India but a change in regional balances. Europe and the USA and the Eastern nation will want to be Indian partners, not just observers, of what is happening in the Indian Dental Scenario.

Publication analysis, as with any method chosen to assess scientific production, does not cover the entirety of scientific production.[5] The major limitation of this research paper is that it is limited to the Scimago™ portal using the Scopus database, and has not included all the published documents. The Scimago journal ranking indicator has been reported in the literature to pose a serious alternative to the well-established journal IF (of ISI database), mainly due to its open-access nature, larger source database and assessment of the quality of citations, and has been accepted as a standard alternative.[6] However, a word of caution is that

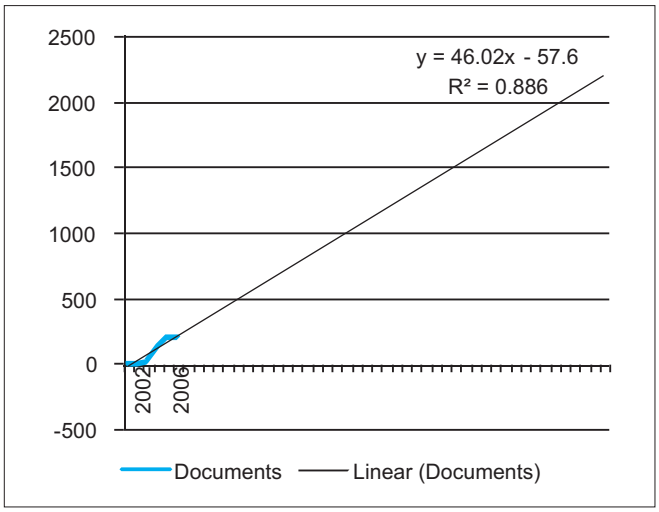


Figure 6: Projection of India's dental publication till 2050

the Scimago journal ranking needs to be evaluated properly before arriving at any definite conclusion over a long period of time.[6,8]

A further possible weakness of the study was its limitation to a 12-year period. It is reported that the inter-annual variation rates of countries varied considerably, with a large rise in the production of some emerging countries and a constant production in some developed countries with long histories of major scientific activity.[5] There are very few published data on Asian and Indian dental research production to confirm or refute the findings of this difference.[5] The present study was also limited to journals included in dentistry, and some dental research papers included in other categories of the Scopus database may have been missed.

The change in academic policies in 2003–2004 has lead to an increased volume of dental publications from India. This raise initially had lead to a decrease in the quality of Indian Dental research by poor citation record, and it has gained momentum. In 2007, the quantity and quality of Indian Dental research articles has reached a peak where it never had been. It can be safely predicted that, if the past 6-year trend persists, India will publish about 1000 articles a year by 2025 and 2200 articles by 2050. It is in the hands of the policy makers that such a pace is maintained and encouraged to scale new heights to place India higher in the global dental research ranking.

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