Profile of scientific production in endodontics in high-impact journals

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ABSTRACT

Objective: To characterize the profile of scientific production in the field of endodontics in high-impact journals. Methods: Articles published from January 2001 to December 2011 in the Journal of Endodontics, International Endodontic Journal, and Australian Endodontic Journal were evaluated. Various aspects were assessed: type of article, authors' geographic origin, changes in the profile of papers over the studied period (in terms of country of origin and type of article), and ratio between budget for science/technology and number of publications. Results: A total of 3,993 articles were published in the 10-year period assessed. Basic research articles accounted for 67.85% of the production, compared to 1.35% of systematic reviews/meta-analyses. The U.S. ranked first in number of publications (23.69%), followed by Brazil (14.22%) and China (6.42%). Despite the low investments made in science, the emerging countries Brazil, China, and Turkey were able to figure among the top five countries in number of publications, especially as a result of increasing numbers of articles in the latest years. Conclusion: Emerging countries are investing increasing amounts in science and technology, which has allowed for a large number of publications in high-impact journals.

Keywords: Endodontics, science, technology, impact factor, journal article.

Perfil da produção científica em endodontia em periódicos de alto impacto

RESUMO

Objetivo: Caracterizar o perfil da produção científica na área de endodontia em periódicos de alto impacto. Métodos: Foram avaliados os artigos publicados entre janeiro de 2001 e dezembro de 2011 nos periódicos Journal of Endodontics, International Endodontic Journal e Australian Endodontic Journal. Vários aspectos foram avaliados, a saber: tipo de artigo, origem geográfica

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dos autores, mudanças no perfil dos artigos ao longo do período estudado (em termos de país de origem e tipo de artigo) e relação entre o investimento em ciência/tecnologia e o número de publicações. Resultados: Um total de 3.993 artigos foram publicados no período de 10 anos estudado. Artigos de pesquisa básica representaram 67,85% da produção, comparados com 1,35% de revisões sistemáticas/metanálises. Os Estados Unidos ficaram em primeiro lugar em número de publicações (23,69%), seguidos pelo Brasil (14,22%) e pela China (6,42%). Apesar dos baixos investimentos feitos em ciência, os países emergentes Brasil, China e Turquia ficaram entre os cinco países com maiores números de publicações, especialmente como resultado do aumento nos números de artigos nos anos mais recentes. Conclusão: Países emergentes estão investindo cada vez mais em ciência e tecnologia, o que permitiu um grande número de publicações em periódicos de alto impacto nos últimos anos.

Palavras-chave: Endodontia, ciência, tecnologia, fator de impacto, artigo de revista.

INTRODUCTION

Scientific research has long been recognized as essential for economic growth in developed countries, and it is now also gaining recognition in emerging countries. One of the effects of this recognition is an increase in investments in science and technology (1). Moreover, the number of professionals dedicated to this activity has increased considerably. Finally, and as a result of those two phenomena, scientific journals and publications have also increased (2-4), a trend that is also observed in dentistry (2,5,6).

The quality of published research may and should be questioned by readers. In addition to the dental contents, the reader should also be able to understand and evaluate methodological and statistical aspects, beyond the study's proposition and conclusion (7). In this scenario, the journal impact factor emerged as a quality indicator of the papers published, as journals indexed in the database that calculates this measure have stricter criteria for the analysis of manuscripts submitted (8).

Journal impact factor is a quantitative tool for evaluating journals. Impact factors are published every year in the Journal Citation Report (JCR) and were created by Thomson Reuters (former Institute for Scientific Information, ISI). The impact factor is calculated based on a 3-year period, and can be considered to be the average number of times published papers are cited up to two years after publication (9).

Many journals are published specifically in the field of endodontics, but only a few of them have a high impact factor. The Journal of Endodontics (JOE) has the highest impact factor in the field (3,291), and the International Endodontic Journal (IEJ) is second (2,383). The Australian Endodontic Journal (AEJ) also has a high impact factor (1,239).

In addition to the journal impact factor, research design is a decisive factor when assessing the strength of the evidence produced. Basic science studies, such as cell studies and investigations of the properties of materials, are important to advance scientific knowledge, but they are not sufficient to promote an evidence-based endodontics. This practice requires clinical studies and systematic reviews, considered to be the top levels in the evidence pyramid, suitable to consolidate scientific knowledge and properly answer the professional's questions (10,11).

Despite the importance of knowing the profile of research produced in endodontics, no studies have so far been conducted with this purpose. Thus, this study aimed to characterize the profile of scientific production in the field of endodontics in high-impact journals.

METHODS

The sample included all volumes published from January 2001 to December 2011 by three high-impact endodontic journals: JOE, IEJ, and AEJ. These journals were selected based on the importance and impact of their publications in the field of endodontics, and for their recognition as state-of-the-art scientific journals from America, Europe, and Asia/Oceania, respectively.

A total of 3,993 articles were retrieved and analyzed, namely, 2,493 (62.43%) from JOE, 1,280 (32.06%) from IEJ, and 220 (5.51%) from AEJ.

The following data were evaluated for each article: type of article, authors' geographic origin, changes in the profile of papers over the studied period (in terms of country of origin and type of article), and ratio between budget allocated for science/technology and number of endodontic publications.

Type of article was determined based on the JOE sessions, defined as follows:

1. Systematic review/meta-analysis: a review with a specific clinical question, congregating results from clinical studies with a well-defined, reproducible methodology (12);

2. Narrative literature review: a descriptive review that provides an overview about a particular topic (12);

3. Clinical research: experimental or observational studies involving humans/patients (13);

4. Basic research/biology: includes animal experiments, cell studies, genetic and physiological investigations (13);

5. Basic research/technology: includes biomechanical investigations and studies of the properties of medications and materials (13);

6. Case report: descriptive study consisting of a detailed report of a patient's case or condition (10).

Geographic origin was defined as the country where the authors' institution belonged. Changes in the profile of papers published over the studied period focused on these two categories (type of article and country of origin). The science and technology budget of the five countries with the highest numbers of publications were described for year 2011 according to official sources (14-18) and related to the number of publications from each country. The ratio was calculated by dividing the total budget for science and technology by the total number of articles published in 2011.

Data were expressed as absolute and relative frequencies and analyzed using descriptive statistics.

RESULTS

The JOE is a monthly journal (12 issues per year) that has increased the number of articles published from 212 in 2001 to 292 in 2011 (226.63 articles per year; range: 164-307). The IEJ is also published monthly and has increased the number of articles from 81 in 2001 to 133 in 2011 (116.36 articles per year; range: 81-139). Finally, the AEJ is published every 4 months (three issues per year), and has also increased the number of articles, from 19 in 2001 to 30 in 2011 (20.00 articles per year; range: 11-30).

Table 1 describes the types of article published by each of the journals analyzed: basic studies in the field of biology showed the highest number of articles (43.88%). Table 2 shows the country of origin of the authors' institution. American institutions accounted for the majority of published articles (23.69%). Table 3 shows the types of article published according to country of origin. Again, the U.S. ranked first in every category, but for case reports, in which the same result was observed for Brazil. Changes in the profile of articles published over the period assessed are described in Table 4. Developed countries, e.g., the U.S. and Japan, showed little changes, while emerging countries, e.g., Brazil, China, and Turkey, showed an important growth in their scientific production in the field of endodontics in the latest years assessed.

TABLE 1 – Types of article published in each of the journals assessed, n (%)

Type of article	JOE	IEJ	AEJ	Total
Systematic review/meta-analysis	41	9	4	54
	(1.64)	(0.70)	(1.82)	(1.35)
Narrative review	67	44	25	136
	(2.69)	(3.44)	(11.36)	(3.41)
Clinical research	421	244	23	688
	(16.89)	(9.06)	(10.45)	(17.23)
Basic research/biology	1,096	604	52	1,752
	(3.96)	(47.19)	(23.64)	(43.88)
Basic research/ technology	651	244	62	957
	(26.11)	(19.06)	(28.18)	(23.97)
Case report	217	135	54	406
	(8.70)	(10.55)	(24.55)	(10.17)

JOE = Journal of Endodontics; IEJ = International Endodontic Journal; Australian Endodontic Journal.

TABLE 2 – Number of articles published in the journals according to country of the authors' institution, n (%)

Country	JOE	IEJ	AEJ	Total
U.S.	832 (33.37)	103 (8.05)	11 (5.00)	946 (23.69)
Brazil	310 (12.43)	208 (16.25)	50 (22.73)	568 (14.22)
China	189 (7.58)	67 (5.23)	2 (0.91)	258 (6.42)
Turkey	142 (5.70)	85 (6.64)	12 (5.45)	239 (5.99)
Japan	131 (5.25)	67 (5.23)	11 (5.00)	209 (5.23)
Italy	123 (4.93)	66 (5.16)	4 (1.82)	193 (4.83)
Germany	76 (3.05)	83 (6.48)	4 (1.82)	163 (4.08)
England	22 (0.88)	117 (9.14)	5 (2.27)	144 (3.61)
Australia	38 (1.52)	32 (2.50)	42 (19.09)	112 (2.80)
Korea	93 (3.73)	13 (1.02)	1 (0.45)	107 (2.68)
Other	510 (21.30)	423 (34.28)	77 (36.49)	1,010 (26.31)

JOE = Journal of Endodontics; IEJ = International Endodontic Journal; Australian Endodontic Journal.

TABLE 3 – Number of articles published in the journals according to country of origin and type of article, n (%)

Country	Systematic review	Narrative review	Clinical research	Basic research/ biology	Basic research/ technology	Case report	Total
U.S.	20 (37.04)	43 (31.62)	198 (28.78)	412 (23.52)	214 (22.36)	59 (14.93)	946 (23.69)
Brazil	2 (3.70)	8 (5.88)	83 (12.06)	251 (14.33)	165 (17.24)	59 (14.93)	568 (14.22)
China	5 (9.26)	1 (0.74)	40 (5.81)	128 (7.31)	69 (7.21)	15 (3.69)	258 (6.42)
Turkey	3 (5.56)	1 (0.74)	33 (4.80)	109 (6.22)	51 (5.33)	42 (10.34)	239 (5.99)
Japan	1 (1.85)	2 (1.47)	27 (3.92)	136 (7.76)	28 (2.93)	15 (3.69)	209 (5.23)
Italy	2 (3.70)	3 (2.21)	16 (3.92)	84 (4.79)	54 (5.64)	34 (8.37)	193 (4.83)
Germany	1 (1.85)	3 (2.21)	21 (3.05)	73 (4.17)	54 (5.64)	11 (2.71)	163 (4.08)
England	0 (0.00)	13 (9.56)	34 (4.94)	58 (3.31)	23 (2.40)	16 (3.94)	144 (3.61)
Australia	4 (7.41)	18 (13.24)	11 (1.60)	33 (1.88)	19 (1.99)	27 (6.65)	112 (2.80)
Korea	0 (0.00)	3 (2.21)	12 (1.74)	60 (3.42)	21 (2.19)	11 (2.71)	107 (2.68)
Other	16 (29.63)	41 (30.15)	213 (30.96)	408 (23.29)	259 (27.06)	117 (28.82)	1,054 (26.40)

TABLE 4 – Profile of articles published in high-impact endodontic journals according to country of origin over the years.

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
U.S.	84 (26.92)	95 (26.99)	99 (33.45)	70 (25.27)	87 (27.80)	129 (34.77)	93 (23.48)	84 (19.63)	52 (15.62)	70 (15.22)	83 (18.24)
Brazil	40 (12.82)	30 (8.52)	34 (11.49)	26 (9.39)	33 (10.54)	36 (9.70)	61 (15.40)	84 (19.63)	60 (19.02)	69 (15.00)	95 (20.88)
China	9 (2.88)	12 (3.41)	9 (3.04)	10 (3.61)	19 (6.07)	24 (6.47)	33 (8.33)	24 (5.61)	32 (9.61)	49 (10.65)	37 (8.13)
Turkey	17 (5.45)	20 (5.68)	10 (3.38)	29 (10.47)	21 (6.71)	25 (6.74)	26 (6.57)	29 (6.78)	14 (4.20)	15 (3.26)	33 (7.25)
Japan	19 (6.09)	25 (7.10)	16 (5.41)	18 (6.50)	16 (5.11)	18 (4.85)	15 (3.79)	22 (5.14)	17 (5.11)	21 (4.57)	22 (4.84)
Italy	20 (6.41)	23 (6.53)	17 (5.74)	10 (3.61)	13 (4.15)	23 (6.20)	16 (4.04)	23 (5.37)	11 (3.30)	20 (4.35)	17 (3.74)
Germany	14 (4.49)	20 (5.68)	17 (5.74)	9 (3.25)	19 (6.07)	17 (4.58)	14 (3.54)	12 (2.80)	12 (3.60)	18 (3.91)	11 (2.42)
England	19 (6.09)	11 (3.13)	3 (1.01)	10 (3.61)	7 (2.24)	11 (2.96)	12 (3.03)	27 (6.31)	16 (4.80)	17 (3.70)	11 (2.42)
Australia	14 (4.49)	10 (2.84)	12 (4.05)	11 (3.97)	11 (3.51)	6 (1.62)	12 (3.03)	9 (2.10)	9 (2.70)	9 (1.96)	9 (1.98)
Korea	5 (1.60)	7 (1.99)	4 (1.35)	9 (3.25)	5 (1.60)	8 (2.16)	5 (1.26)	15 (3.50)	9 (2.70)	23 (5.00)	17 (3.74)
Other	71 (22.76)	99 (28.13)	75 (25.34)	75 (27.08)	82 (26.20)	74 (19.95)	109 (27.53)	99 (23.13)	101 (30.33)	149 (32.39)	120 (26.37)

Table 5 shows the science and technology budget of the five countries with the highest numbers of articles published in high-impact endodontic journals and its relationship with the number of publications in 2011. The budget allocated for science and technology by the two developed countries was significantly higher than that allocated by the emerging countries.

TABLE 5 – Ratio between science and technology budget and number of articles published among the five countries with the highest numbers of publications in high-impact endodontic journals

Country	2011 budget (million US$)	2011 publications	Budget/article ratio (million US$)
Brazil (14)	7,299	95	76.83
Turkey (15)	24,566*	33	744.42
U.S. (16)	66,000	83	795.18
China (17)	29,600	37	800.00
Japan (18)	45,600	22	2,072.72

* Data from 2010.

DISCUSSION

Articles published in high-impact endodontic journals represent the state of the art of scientific knowledge produced in the field around the world. JOE, IEJ, and AEJ are three top quality endodontic journals, with high impact factors, coming from different continents. As a result, they disseminate knowledge produced at different regions and can help improve our understanding of the profile of scientific production worldwide.

As expected, the U.S. accounted for almost a quarter of all articles published. Brazil and China ranked second and third, respectively, in number of publications, corroborating the impression that emerging countries are increasing their share in producing scientific knowledge. A previous study designed to evaluate the contributions of different world regions in the top 50 biomedical journals from 1995 to 2002 found that developed regions were responsible for the majority of the scientific production contribution (4). This finding provides further evidence of the increment in scientific production coming from emerging countries in the last few years (1).

In 2004, Cury (19) described a significant increase in the number of Brazilian dental publications indexed in MEDLINE: the number of publications indexed in the first three years of this century (n=758) was almost double the number of journals indexed in the entire previous century (n=423). According to the author, this increase was motivated by the policies established at the Coordination for the Improvement of Higher Education Personnel (CAPES) and at the National Council for Scientific and Technological Development (CNPq), which encouraged researchers to publish their papers in high-impact journals (19,20).

This study observed a significant relationship between number of publications in high-impact endodontic journals and the budget allocated for science and technology in each country. Japan was the country with the highest ratio, as high as 2,072.72 million US$ per article. U.S. had the highest number of publications, which probably also reflected the high budget allocated to science and technology (16). These data suggest that investment in science and technology ultimately leads to a high number of scientific publications.

Emerging countries showed great differences in their science and technology budgets in 2011. While China and Turkey had the third and fourth highest budgets (15,17), Brazil (14) had a budget almost four times lower than that of China. Conversely, the number of Brazilian articles in high-impact journals was greater than those of the other two countries and even than the number of Japanese articles. Moreover, the specific budget share allocated to the health sciences area, especially to dentistry and endodontics, may have influenced the results. Such difference could probably explain, for example, why Japan had the second highest budget but the lowest number of publications, and also why Brazil ranked second in number of publications but spent much less per article than the other four countries. Finally, the policies established by each country to evaluate their own scientific production may also influence the number of scientific publications in high- impact journals (19,20).

The types of studies conducted in a give field of science are decisive in producing and advancing knowledge. Particularly in dentistry, evidence-based articles have long been advocated as essential to transform clinical practice (12). In the scientific evidence pyramid, created to illustrate the quality of scientific evidence originating from different types of study, systematic reviews and meta-analyses come first, as they congregate findings produced by clinical trials and discuss their results (11,12). Despite the high value of such studies, these were the least frequent types of research published. This is in line with a recent study showing complete absence of systematic reviews among the 100 top cited articles in endodontic journals (21).

Basic studies were the ones showing the highest numbers. Biology and technology together were responsible for 67.78% of the scientific production in the field of endodontics from 2001 to 2011. Notwithstanding, these studies rank low in the evidence pyramid (11,12). Even though it is important to select the correct study type according to the design of each research project, scientific questions can only be properly answered if the study is performed at a qualitatively high level (13). Moreover, the power of research to answer a scientific question should be analyzed taking into consideration the level of evidence associated with each study design (12). As a result, for some questions, the scientific evidence available may not be strong enough to adequately help find an answer.

CONCLUSION

Emerging countries are investing increasing amounts in science and technology, which has allowed for a large number of publications in high-impact journals.

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