

ORIGINAL ARTICLE**Oral Potentially Malignant Disorders**

Highly cited dental articles and their authors: An evaluation of publication and citation characteristics

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Abstract

Aim: In the present study, we aimed to identify and analyze the characteristics of highly cited articles in dentistry.

Methods: All articles belonging to Web of Science category of “dentistry, oral surgery and medicine” published until 2016 were analyzed. The bibliometric data of the highly cited articles were evaluated. The Y-index was applied to assess authors’ publication potential. Altmetric scores were recorded from Dimensions, a free online database.

Results: There were 3666 highly cited dentistry articles published in dental journals. Half of them were published in seven leading journals in their specialties. The major contributing countries were the USA, Sweden, the UK, and Switzerland. The highly cited articles were written by 3.7 authors on average. Jan Lindhe had the largest number of highly cited articles, whereas David H. Pashley had the highest potential to publish highly cited articles in dentistry.

Conclusions: Highly cited articles were distributed among various dental specialties, and the most productive periods were the late 1990s and the early 2000s. The Y-index gave dimensional details of the prolific authors. The current analysis was based on data extracted from Web of Science. Results could be different if data were extracted from other databases, such as Google Scholar.

KEYWORDS

bibliometric, citation, classic article, implant, Web of Science

1 | INTRODUCTION

In general, the number of citations a scientific article receives might reflect its academic impact. A bibliometric study can be conducted to evaluate the publication and citation data of a selected body of literature in order to identify the highly cited articles, their authors, and journals responsible for publishing them.¹ By doing so, the popular research themes might be identified to enable researchers to quickly grasp the cores of current research and plan for future studies.² The bibliometrics of various dental research fields, such as dental implantology, have been extensively studied. Published bibliometric studies of dental implantology have reported the most cited implant articles,³ popular research topics,⁴ and highly cited authors.⁵ However, when

global dental research is considered as a whole, the existing literature has only reported the top 100 most cited publications,⁶ the overall publishing landscape of dentistry during 1999-2003,⁷ and 2007-2011,⁸ as well as the performances of dental journals during 2003-2012.⁹ The bibliometric information of the small but important share of the highly cited dental articles was missing. Therefore, instead of including only the top 100 most cited articles or the whole dental literature within a predefined survey period, the aims of the present study were to identify and analyze the characteristics of the highly cited articles in dentistry published in all time with regard to author, country, institution and journal performances. Moreover, the current study evaluated the authors with Y-index, an indicator developed to evaluate contributions of individual authors by assessing the authorships in terms of

first and corresponding authorships¹⁰ instead of merely counting the total number of authorship, which will be discussed further.

2 | MATERIALS AND METHODS

2.1 | Data source

The data source used in the present study was the Science Citation Index Expanded (SCI-EXPANDED) database of the Clarivate Analytics (formerly known as the Thomson Reuters and the Institute for Scientific Information) Web of Science Core Collection. The Web of Science category of “dentistry, oral surgery and medicine” was first introduced in 1945. Until the publication year of 2016, a total of 366 766 documents were found in this category. For the current study, we only considered articles, but excluded other documents, such as reviews. In total, there were 209 161 articles in the dataset to be analyzed. We downloaded full records and the citation data for all the included articles and analyzed them using Microsoft Excel 2016 (Microsoft, Redmond, WA, USA). The impact factor (IF_{2016}) of a journal was determined for each article, as reported in the Journal Citation Reports (JCR) 2016.

2.2 | Data processing

In the SCI-EXPANDED database, the corresponding author is designated as the “reprint” author. In the present study, we use the term “corresponding author”.¹⁰ In a single-author article where the authorship is unspecified, the single author is both the first author and corresponding author.¹¹ Similarly, in an article affiliated to one institution, the institution is classified as the first author institution and the corresponding author's institution.¹¹ To analyze data from the country level, various regions or territories were recoded during the data processing. England, Scotland, Northern Ireland, and Wales were reclassified as the UK. The Federal Republic of Germany and West Germany were included into Germany. Hong Kong was included into China. Affiliations in Yugoslavia were checked and reclassified as being from Serbia, Bosnia, and Herzegovina, and Croatia. Affiliations in Czechoslovakia were checked and reclassified as being from Czech Republic.

2.3 | Definitions of highly cited articles

We defined highly cited articles as those with ≥ 100 citations from the Web of Science Core Collection since publication until 2016 (TC_{2016}).¹¹ Moreover, articles with $TC_{2016} \geq 1000$ were defined as classic articles.^{12,13} We also analyzed articles according to the number of citations they received in the single year of 2016 (C_{2016}) and in the year of publication (C_0). These three parameters were used for the citation analysis, because an article might not be cited in the same manner over the years.¹⁴ Their altmetric scores were recorded from Dimensions, a free online database (www.dimensions.ai/). In addition, by recording the number of publications published in a publication year (TP), we calculated citations per publication (CPP_{2016}) for each publication year as TC_{2016}/TP .

2.4 | Performance indicators for countries and institutions

Six publication indicators: the numbers of total articles, independent articles, collaborative articles, first author articles, corresponding author articles, and single-author articles were used to evaluate the publication performances of institutions and countries.

2.5 | Y-index of authors

It has been widely accepted that the first and corresponding authors contribute the most in a paper.^{15,16} The Y-index was proposed in recent years to assess publication potential and characterize the scientific contributions by authors, institutions, and countries in terms of the numbers of first author publications (FP) and corresponding author publications (RP).¹⁰ The Y-index with two parameters (j, h) can visualize and compare different authors' contributions and is defined as:

$$j = FP + RP \quad (1)$$

$$h = \tan^{-1} \left(\frac{RP}{FP} \right). \quad (2)$$

When an author had a larger j, he or she would be positioned farther away from origin of the polar coordinates (0, 0) in the Y-index diagram (Figure 1). When an author had the same number of first author articles and corresponding author articles, he or she would be positioned in the diagonal line with an h value of 45° or .7854 (in radian). When $h > .7854$, the author has published more corresponding author articles than first author articles, and he or she would be positioned in the upper left half of the Y-index diagram. In contrast, when $h < .7854$, the author has published more first author articles than corresponding author articles, and he or she would be positioned in the lower right half of the diagram. When $h = 0$, j = number of first author articles, and the author would position on the X-axis of the diagram. When $h = \pi/2$, j = number of corresponding author articles, and the author would position on the Y-axis of the diagram.

3 | RESULTS

3.1 | Publication years

A total of 3666 highly cited articles with $TC_{2016} \geq 100$ in the Web of Science category of “dentistry, oral surgery and medicine” were identified, all of which were published in English. The distribution of these highly cited articles and their CPP_{2016} by year is shown in Figure 2. The highly cited articles were published during 1945-2014. It seems that the year 1948 had the highest citations per publication ($CPP_{2016} = 474$). There was only one highly cited article published in 1948, entitled “Variations in facial relationships: Their significance in treatment and prognosis”, that was related to orthodontics.¹⁷ There were two highly cited articles published in 2014 concerning medication-related osteonecrosis of the jaws¹⁸ and diagnostic criteria for temporomandibular disorders,¹⁹ which received 70 and 64 citations,

FIGURE 1 Top 43 authors with Y-index ($j \geq 12$)

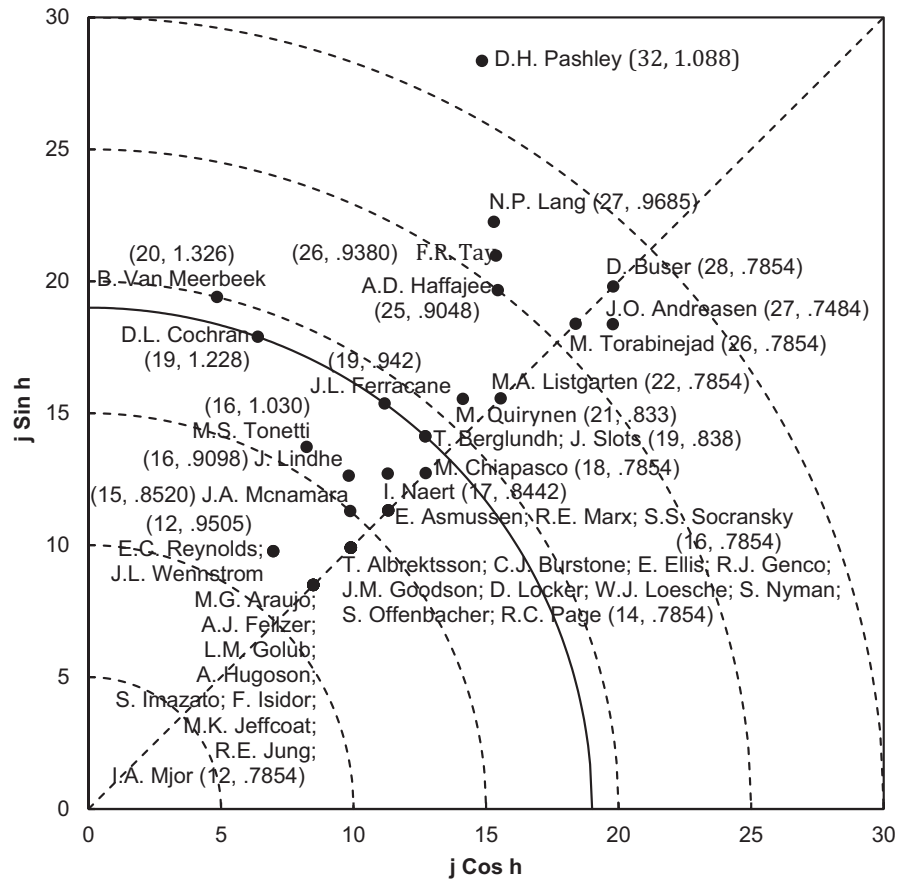
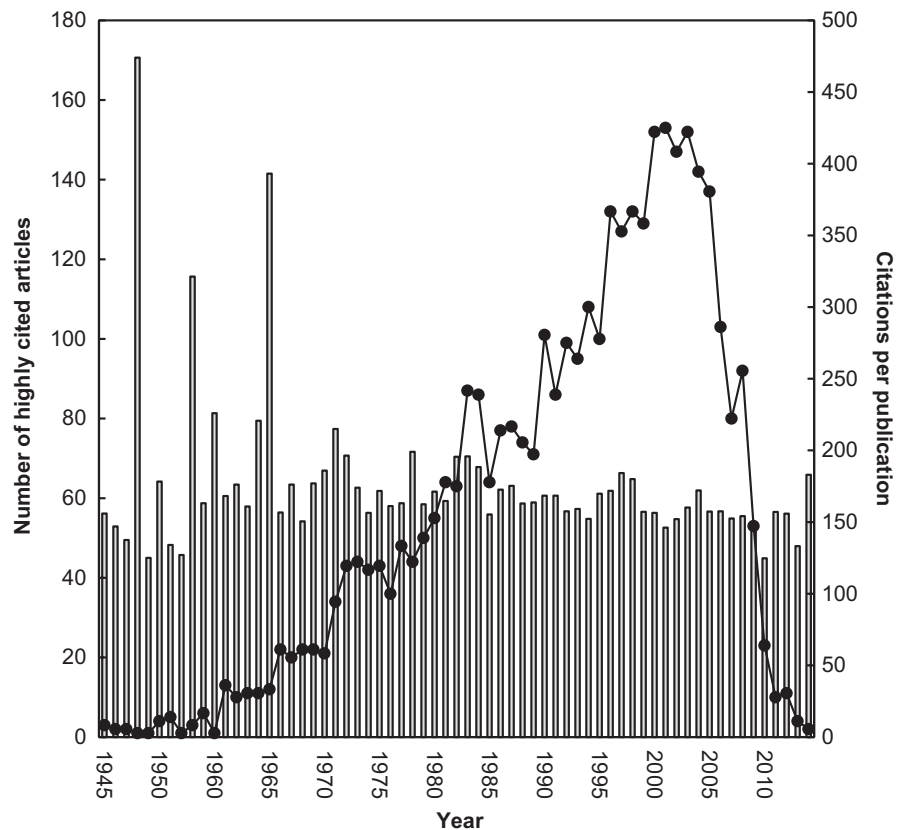


FIGURE 2 Number of highly cited articles and citations per publication by year. \square , CPP2016; \bullet , Number of highly cited articles



respectively, in 2016 (C_{2016}) alone. They ranked second and sixth in terms of C_{2016} .

3.2 | Journals

The highly cited articles were published in 76 dentistry journals, 21 of which were not listed in SCI-EXPANDED in 2016. Seven journals published 50% of the 3666 highly cited articles, including *Journal of Dental Research* ($IF_{2016} = 4.755$, ranked second in the "Dentistry, oral surgery and medicine" category), which published the largest number of highly cited articles ($N = 391$, 11% of 3666), followed by *Journal of Periodontology* ($IF_{2016} = 3.030$, 10th) ($N = 386$, 11%), *Journal of Clinical Periodontology* ($IF_{2016} = 3.477$, eighth) ($N = 285$, 7.8%), *Clinical Oral Implants Research* ($IF_{2016} = 3.624$, sixth) ($N = 212$, 5.8%), *Journal of Prosthetic Dentistry* ($IF_{2016} = 2.095$, 25th) ($N = 194$, 5.3%), *American Journal of Orthodontics and Dentofacial Orthopedics* ($IF_{2016} = 1.472$, 44th) ($N = 181$, 4.9%), and *Journal of Endodontics* ($IF_{2016} = 2.807$, 15th) ($N = 139$, 3.8%). It should be noted that *Oral Oncology* ($IF_{2016} = 4.794$, first) has published 24 (.65%) highly cited articles only. However, *Journal of the Canadian Dental Association* published one highly cited article and had the lowest IF_{2016} (.514) among the journals with highly cited articles.

3.3 | Citation life-cycles of highly cited articles

A total of 158 (4.3%) highly cited articles had no citation in the most recent year ($C_{2016} = 0$), and 2585 articles (71%) had no citation in the publication year ($C_0 = 0$). There were five articles with $C_{2016} > 100$, and

their citation life curves are shown in Figure 3. These five articles were published during 1975-2014, and had increasing trends of citations after their publications. In particular, the article by Ainamo and Bay ($C_{2016} = 107$, ranked fourth, $TC_{2016} = 1110$, ranked fifth) had fewer than 20 annual citations during 1975-2005.²⁰ After 30 years of publication, its annual citation count has been increasing steadily and exceeded 100 in 2014 and 2016. Another highly noticeable article was that of Socransky et al.,²¹ which had a constantly increasing trend on annual citation count after its publication ($C_{2016} = 172$, ranked first, $TC_{2016} = 1771$, ranked second). If the 3666 highly cited articles were ranked according to C_{2016} and C_0 , then 84% of the top 100 articles by C_{2016} were not ranked in top 100 by C_0 . This implies that the highly cited articles might not always have high impact or visibility in research society.

There were six classic articles ($TC_{2016} > 1000$) published during 1965-2004 and their citation lives are shown in Figure 4. It seems all of them have been constantly accumulating citations. Meanwhile, Ainamo and Bay, Socransky et al., and O'Leary et al ranked top 10 in both TC_{2016} and C_{2016} ,²⁰⁻²² all of which were related to periodontology. The TC_{2016} , C_{2016} , and C_0 of the six classic articles are listed in Table 1. It could be observed that these classic articles have contributed to numerous patents.

3.4 | Publication performances: Countries and institutions

Among the 3666 highly cited articles, 304 (8.3%) of them did not have author affiliation information according to Web of Science data. The

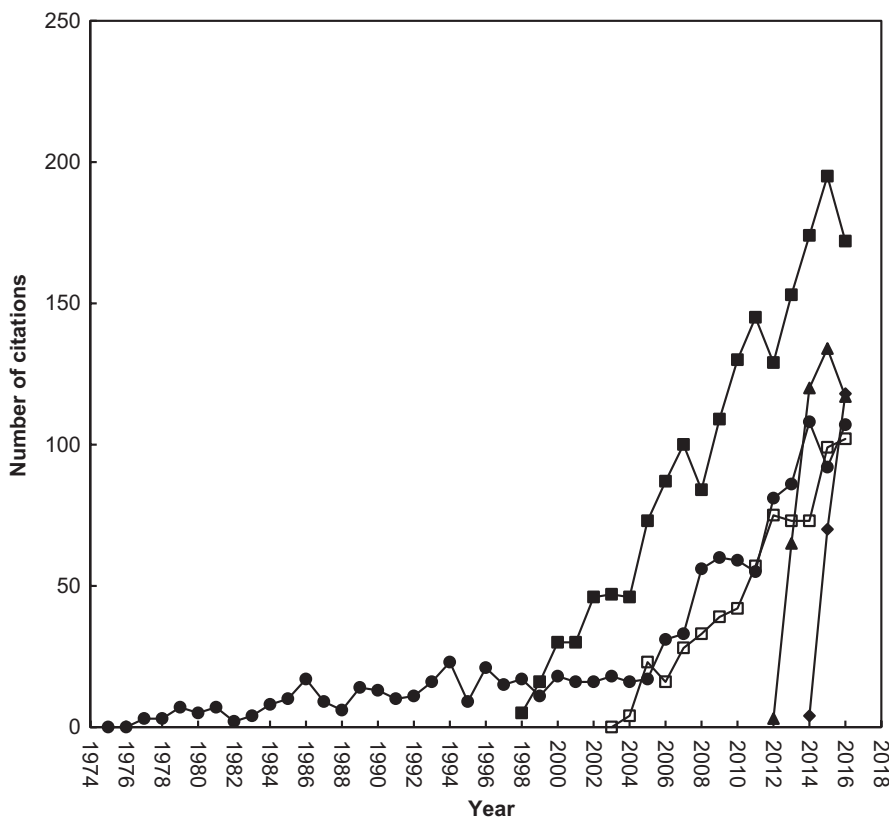


FIGURE 3 Citation life of the five highly cited articles with >100 citations in 2016 (C_{2016}). —■—, Socransky et al (1998), $C_{2016} = 172$, TC_{2016} rank 2; —◆—, Ruggiero et al (2014), $C_{2016} = 118$, TC_{2016} rank 768; —▲—, Eke et al (2012), $C_{2016} = 117$, TC_{2016} rank 82; —●—, Ainamo and Bay (1975), $C_{2016} = 107$, TC_{2016} rank 5; —□—, Petersen (2003), $C_{2016} = 102$, TC_{2016} rank 25

FIGURE 4 Citation life of the six classic articles with >1000 total citations until 2016 (TC_{2016}). ■, Loe et al (1965), $TC_{2016} = 1774$, rank 1; ←, Socransky et al (1998), $TC_{2016} = 1771$, rank 2; ▲, Donath and Breuner (1982), $TC_{2016} = 1245$, rank 3; ●, Marx et al (1998), $TC_{2016} = 1240$, rank 4; □, Ainamo and Bay (1975), $TC_{2016} = 1110$, rank 5; ▲, Ruggiero et al (2004), $TC_{2016} = 1098$, rank 6

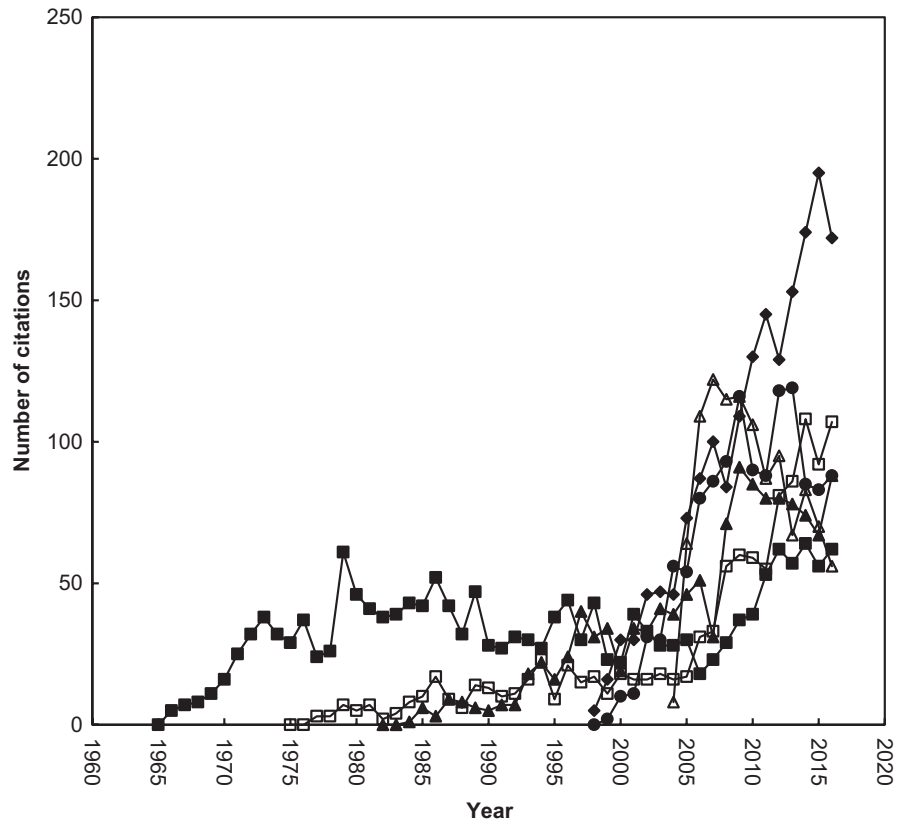


TABLE 1 Six classic articles in the Web of Science category of dentistry, oral surgery, and medicine ($TC_{2016} >1000$)

Rank (TC_{2016})	Rank (C_{2016})	Rank (C_0)	Altmetric score (details)	Classic article information
1 (1774)	23 (62)	1082 (0)	13 (1 policy source, 1 tweeter, 4 patents)	Löe, H., Theilade, E. and Jensen, S.B. (1965), Experimental gingivitis in man. <i>Journal of Periodontology</i> , 36 (3), 177-187.
2 (1771)	1 (172)	41 (5)	9 (1 policy source, 3 tweeters, 13 patents)	Socransky, S.S., Haffajee, A.D., Cugini, M.A., Smith, C. and Kent, R.L. (1998), Microbial complexes in subgingival plaque. <i>Journal of Clinical Periodontology</i> , 25 (2), 134-144.
3 (1245)	11 (88)	1082 (0)	3 (2 patents)	Donath, K. and Breuner, G. (1982), A method for the study of undecalcified bones and teeth with attached soft tissues: The Säge-Schliff (sawing and grinding) technique. <i>Journal of Oral Pathology & Medicine</i> , 11 (4), 318-326.
4 (1240)	11 (88)	1082 (0)	13 (1 news outlet, 1 tweeter, 1 patent)	Marx, R.E., Carlson, E.R., Eichstaedt, R.M., Schimmele, S.R., Strauss, J.E. and Georgeff, K.R. (1998), Platelet-rich plasma: Growth factor enhancement for bone grafts. <i>Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontics</i> , 85 (6), 638-646.
5 (1110)	4 (107)	1082 (0)	Not available	Ainamo, J. and Bay, I. (1975), Problems and proposals for recording gingivitis and plaque. <i>International Dental Journal</i> , 25 (4), 229-235.
6 (1098)	32 (56)	7 (8)	4 (1 tweeter, 1 patent)	Ruggiero, S.L., Mehrotra, B., Rosenberg, T.J. and Engroff, S.L. (2004), Osteonecrosis of the jaws associated with the use of bisphosphonates: A review of 63 cases. <i>Journal of Oral and Maxillofacial Surgery</i> , 62 (5), 527-534.

C_0 = number of citations in publication year; C_{2016} = number of citations in 2016; TC_{2016} = number of citations from publication until the end of 2016.

61% of the articles produced by the USA were internationally collaborative articles. These 3362 articles had an average of 165 citations (CPP_{2016}); 2613 of them (78% of 3362) were country-independent articles from 41 countries ($CPP_{2016} = 163$), whereas 749 (22%) articles were internationally collaborative articles from 65 countries

($CPP_{2016} = 170$). Two American countries, seven European countries, and one Asian country were the top 10 contributors of the highly cited articles (Table 2). With the exception of France, the G7 (Canada, France, Germany, Italy, Japan, the UK, and the USA) were ranked in the top 10. The USA was the dominant contributor, producing 47% of the

TABLE 2 Top 10 productive countries

Country	TP	TP R (%)	IP R (%)	CPR (%)	FP R (%)	RP R (%)	SP R (%)
USA	1585	1 (47)	1 (41)	1 (61)	1 (41)	1 (39)	1 (40)
Sweden	440	2 (13)	2 (11)	2 (20)	2 (11)	2 (11)	2 (13)
UK	311	3 (9.3)	3 (7.3)	4 (15)	3 (7.1)	3 (7.3)	3 (11)
Switzerland	241	4 (7.2)	7 (3.7)	3 (19)	4 (4.6)	4 (4.9)	5 (5.0)
Japan	210	5 (6.2)	4 (4.3)	5 (13)	5 (4.5)	5 (4.8)	9 (2.6)
Germany	167	6 (5.0)	8 (3.4)	7 (10)	6 (3.7)	6 (4.0)	10 (2.1)
Netherlands	155	7 (4.6)	6 (3.9)	12 (6.5)	7 (3.6)	7 (3.6)	10 (2.1)
Denmark	142	8 (4.2)	10 (3.0)	8 (8.1)	9 (3.2)	9 (3.2)	4 (6.3)
Italy	142	8 (4.2)	11 (2.3)	6 (10)	8 (3.3)	8 (3.3)	16 (0.53)
Canada	139	10 (4.1)	9 (3.2)	11 (6.9)	9 (3.2)	10 (3.2)	6 (3.7)

CP = collaborative articles; FP = first author articles; IP = independent articles; R = rank; RP = corresponding author articles; SP = single-author articles; TP = number of total articles.

highly cited articles. It ranked top in all six indicators and was followed by Sweden. The USA also had the most frequent partnership, accounting for 61% of all the internationally collaborative articles.

With regard to institutions, 1715 articles (51% of 3362) were single institution articles ($CPP_{2016} = 165$), whereas 1647 articles (49%) were inter-institutionally collaborative ($CPP_{2016} = 165$), in which 898 were nationally collaborative ($CPP_{2016} = 161$) and 749 were internationally collaborative articles ($CPP_{2016} = 170$). The characteristics of the top 10 institutions are shown in Table 3. All of them had >70 highly cited articles. Collectively, the top 10 institutions contributed to 930 highly cited articles (28% of 3362). Seven institutions were based in the USA, two in Sweden, and one in Switzerland. The University of Bern in Switzerland took the leading position not only in total publications (N = 140 articles, 4.2% of 3362 articles with author information) but also in inter-institutionally collaborative articles (N = 100 articles, 6.1% of 1647 inter-institutionally collaborative articles). Gothenburg University in Sweden ranked top in first author articles (N = 92 articles, 2.7% of 3362 first author articles) and corresponding author articles

(N = 82 articles, 2.7% of 3044 corresponding author articles). The University of Michigan in the USA ranked top in institutional independent articles (N = 55 articles, 3.4% of 1715 institutional independent articles).

3.5 | Publication performances: Authors

The number of authors per highly cited article was 3.7, and the highest number of authors per article was 34. Of the 3666 highly cited articles, 495 (14%) were written by single author, 705 (19%) by two authors, 765 (21%) by three authors, 673 (18%) by four authors, 421 (11%) by five authors, and 607 (17%) by more than five authors. Only 2933 articles (83% of 3666) had both the first author and corresponding author's names in the Web of Science database and these were used to compute the Y-index for authors.

These 2933 articles were contributed by a total of 6517 authors. Only 1608 authors (25% of 6517) had both first and corresponding author articles, whereas 4582 (70%) authors had no first author article and 4723 (72%) authors had no corresponding

TABLE 3 Top 10 productive institutions

Institution	TP	TP R (%)	IP R (%)	CPR (%)	FPR (%)	RPR (%)	SPR (%)
University of Bern, Switzerland	140	1 (4.2)	3 (2.3)	1 (6.1)	3 (2.2)	3 (2.3)	15 (1.3)
Gothenburg University, Sweden	131	2 (3.9)	2 (3.0)	3 (4.8)	1 (2.7)	1 (2.7)	2 (2.4)
University of Texas, USA	122	3 (3.6)	10 (1.6)	2 (5.7)	5 (2.0)	6 (1.7)	15 (1.3)
University of Michigan, USA	114	4 (3.4)	1 (3.2)	6 (3.6)	2 (2.3)	2 (2.4)	2 (2.4)
University of Gothenburg, Sweden	108	5 (3.2)	8 (1.9)	4 (4.6)	6 (2.0)	5 (2.0)	8 (1.6)
University of North Carolina, USA	98	6 (2.9)	3 (2.3)	7 (3.5)	4 (2.1)	4 (2.0)	19 (1.1)
University of Washington, USA	84	7 (2.5)	6 (2.0)	10 (3.0)	8 (1.5)	8 (1.4)	2 (2.4)
Medical College of Georgia, USA	82	8 (2.4)	11 (1.5)	8 (3.5)	8 (1.5)	7 (1.5)	6 (1.8)
Harvard University, USA	79	9 (2.3)	53 (.47)	5 (4.3)	23 (.83)	30 (.66)	30 (.79)
State University of New York at Buffalo, USA	77	10 (2.3)	6 (2.0)	12 (2.6)	7 (1.5)	10 (1.4)	19 (1.1)

TP = total number of highly cited articles; TPR (%), IPR (%), CPR (%), FPR (%), RPR (%), and SPR (%): the rank and percentage of total articles, single institution articles, inter-institutionally collaborative articles, first author articles, corresponding author articles, single-author articles in their total articles.

author article. In particular, 102 authors (1.6% of the 6517 authors) had more corresponding author articles than first author articles ($\pi/2 > h > .7854$), 26 authors (.40%) had more first author articles than corresponding author articles ($0 < h < .7854$), and 1480 (23%) authors had the same numbers of first author and corresponding author articles ($h = .7854$). A total of 186 (2.9%) authors published only corresponding author articles ($h = 1.5708$), and 327 (5.0%) authors published only first author articles ($h = 0$). The distribution of the Y-index (j, h) of the top 43 authors with $j \geq 12$ is shown in Figure 1. Each dot has a coordinate (j, h) that could represent one author or many authors. David H. Pashley published 58 highly cited articles, including 11 as the first author and 21 as the corresponding author. Therefore, he had the highest j of 32 (and $h = 1.088$), followed by Daniel Buser ($j = 28$). Among these 43 authors, Jens O. Andreasen ($j = 27, h = .7484$) was the only one who had more first author articles than corresponding author articles ($h < .7854$, positioned in the lower right half of the diagram). There were 26 authors positioned on the diagonal line ($h = .7854$) with the same number of first author and corresponding author articles. Furthermore, Jan Lindhe published the largest number of highly cited articles ($N = 81$), including seven first author and nine corresponding author articles ($j = 16, h = .9098$).

4 | DISCUSSION

There has been a long history in the investigations of citation trends of scientific articles.¹⁴ In recent years, there have been multiple studies reporting the citation life-cycles of highly cited articles ($TC_{\text{year}} \geq 100$) in numerous Web of Science categories, including chemical engineering,²³ materials science,²⁴ and information science and library science.²⁵ Results from these studies have shown that a highly cited article might not always have many citations in every year.²⁶ Therefore, extra indicators, such as the number of citations received in the year 2016 (C_{2016}) and in the publication year (C_0), might provide additional information for readers to understand the impact of a highly cited article today and immediately after publication. The current results have shown that the 3666 highly cited articles ranked differently if sorted by C_{2016} than sorted by C_0 . A similar difference was also observed in material science articles, in which 73% of the top 100 articles by C_{year} were not ranked in the top 100 by C_0 .²⁴ This has never been investigated in dentistry articles, which could be considered a strength of the current study.

From our results, there were two classic articles with both large TC_{2016} and C_{2016} , written by Ainamo and Bay and Socransky et al.^{20,21} The former article proposed the famous gingival bleeding index that records the percentage of gingival sites with bleeding when pressure is applied to the gingival margins, as well as the plaque index that records the percentage of tooth surfaces covered with clearly visible dental plaque. These indexes are used in daily dental practice to record the oral hygiene and gingival health of patients. The latter article reported the five major complexes of bacteria present in the

subgingival plaque. The identification of the periodontopathogens is fundamental to the understanding and investigation of periodontal disease. These two articles were also included in the list of top 100 most cited dentistry publications compiled in 2014.⁶

The ratio of contributions of the journals to the 3666 highly cited articles identified in the current study were different from that to the top 100 most cited publications reported by Feijoo et al.⁶ Our results have found a reduced ratio of contributions by *Journal of Dental Research* (11% vs 16%), *Journal of Periodontology* (11% vs 18%), and *Journal of Clinical Periodontology* (7.8% vs 20%), whereas others had an increased ratio of contributions relative to the top 100 list, such as *Clinical Oral Implants Research* (5.8% vs 2%), *Journal of Prosthetic Dentistry* (5.3% vs 3%), *American Journal of Orthodontics and Dentofacial Orthopedics* (4.9% vs 3%), and *Journal of Endodontics* (3.8% vs 1%). However, it should be noted that the current study only included publications classified by Web of Science as articles, so reviews and meta-analyses (often highly cited) from the top 100 list by Feijoo et al. were not considered here.⁶ Regardless of the differences, the results from both studies suggest that these areas of research, especially periodontology and implantology, are of high impact in terms of citations received.

The Y-index (j, h) is helpful in differentiating the performances of authors, especially when the j value (first author articles + corresponding author articles) is the same. For example, the j value of Tord Berglundh (19, .8380), Jørgen Slots (19, 0.8380), Jack L. Ferracane (19, 0.9420), and David L. Cochran (19, 1.228) were all the same ($j = 19$). However, the h value of Cochran was 1.228, that of Ferracane was .9420, and that of the other two was .8380. That means that Cochran had a greater proportion of corresponding author articles to first author articles than the others, which in turn might imply that he has taken up a more senior role in supervising or coordinating research team members to publish. If we considered the seven authors with ≥ 25 highly cited articles, such a pattern of a more senior role became more obvious, as all but one had more corresponding author articles than first author articles. These authors focused on research in material science (David H. Pashley, Frank R. Tay), implantology (Niklaus P. Lang, Daniel Buser), traumatology (Jens O. Andreasen), endodontology (Mahmoud Torabinejad), and periodontology (Anne D. Haffajee). The predominance of these areas of research coincided with a previous study that identified the top 100 most cited dentistry publications.⁶ It was also reported that some dental journals improved their impact factors significantly due to the citations from material science.²⁷ The contributions from these productive authors contributed to the high rankings of the USA (Haffajee, Pashley, Tay, and Torabinejad), Switzerland (Buser and Lang) and Denmark (Andreasen). Meanwhile, nearly one-seventh of the highly cited articles had single authorship. A similar ratio of single-author articles was found in the highly cited articles in categories of chemical engineering and materials science.^{23,24}

Readers should be aware that the current analysis was based on data extracted from the Web of Science; therefore, the results could be different if data were extracted from other databases, such as Google Scholar.

4.1 | Conclusion

A total of 3666 highly cited articles were identified in Web of Science category of "Dentistry, oral surgery and medicine" from 1945 to 2014. Highly cited articles were published not only in earlier years but also in recent years. The *Journal of Dental Research* and *Journal of Periodontology* published the largest share of these highly cited articles. A considerable number of highly cited articles were published in dental journals that were leading in their specialties. The article by Socransky et al. in 1998 might be considered one of the most influential original articles in the history of dentistry.²¹ European countries and institutions were major contributors to the articles. Jan Lindhe had the largest number of highly cited articles. David H. Pashley was one of the most productive authors in terms of the Y-index. A considerable number of the highly cited articles came from material science, periodontology, and implantology.

4.2 | Clinical relevance

Quite often different clinicians refer to different journal articles to support evidence-based practice of dentistry. The articles might not be representative in terms of scientific citations. The article by Socransky et al. in 1998 was one of the most influential original articles in dentistry, which reported the five major complexes of bacteria present in subgingival plaque.²¹ The identification of periodontopathogens is fundamental to the management of periodontal disease. The current report identified the most influential original articles and authors in dentistry. The information is beneficial to teaching and research.

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