

## Bibliometric Analysis of the 100 Most Cited Articles on Oral Biology

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### Abstract

Oral biology is a field in dentistry that focused on molecular biology and oral health. This specialized science-related subject that aims to develop mechanistic understanding of oral tissue development and function in relation to tissue structure, oral health and disease, thereby forming a basis for clinical training and practice. Several methods are used to evaluate the quality of an article in a particular field, starting from the impact factor, the quality of the journal, the quartile, to how many articles are read or followed by other authors. The number of citations obtained from an article should illustrate that the article is capable of providing information and knowledge in that field.

Scopus database was used to retrieve the data regarding the citation information of the published papers on Oral Biology. The data was accessed on 20th December 2020 and hence all the citations related matrixes were of this time point. The search used the medical term "Oral Biology" and this term was searched in the keywords, titles and text options of the Scopus database.

Total 1277 articles were obtained from the search with h index and h index after excluding self-citations of 79 and 74 respectively. Based on the citations received, 100 most influential articles were sorted which account for 7,83% of the total articles obtained through the search (Supplementary file 1). From 32 different journals were associated with the 100 most cited articles (Table 1). Journal of Dental Research (29 articles) topped in total contribution followed by Oral Oncology (11 articles), Critical Reviews in Oral Biology and Medicine (6 articles) and Periodontology 2000 (6).

So far, this article is the first in the field of oral biology to address the most cited articles. There is a predominance of review articles with authors from European and US countries. In addition, in this decade, the most cited journals are those with high impact factors and high quartiles as well. Funding also describes the number of articles published in the field of oral biology. It is hoped that this research will serve as an important source of information for researchers, academics, and students.

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### Introduction

Decade ago, dentistry was primarily a skill-centered profession. Dentistry focused the ability to acquire technical knowledge and expertise. Nevertheless, science has played an important role in the development of dentistry as

an underlying discipline of clinical knowledge and application. Especially biological science, had potential role in scientific knowledge from the 20th century. This fields enables students to appreciate evidence-based medicine and to understand and apply new therapeutic and diagnostic developments and technologies<sup>1</sup>.

Oral biology is subject represents link between basic sciences and the clinical field. This field is needed on dentistry to develop quality itself. Oral biology is a field in dentistry that focused on molecular biology and oral health. This specialized science-related subject that aims to develop mechanistic understanding of

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oral tissue development and function in relation to tissue structure, oral health and disease, thereby forming a basis for clinical training and practice<sup>2</sup>.

Several methods are used to evaluate the quality of an article in a particular field, starting from the impact factor, the quality of the journal, the quartile, to how many articles are read or followed by other authors. The number of citations obtained from an article should illustrate that the article is capable of providing information and knowledge in that field. Both show their own capacity, updates and new information as well as discussions that lead to controversy. Even though there are many positive views from the many excerpts of an article, there are many other things that must be considered, starting from the relevance and quality of the writing itself<sup>3</sup>.

However, given the amount of controversy that exists, the content of the number of citations in the article itself has an impact on current knowledge. Even after some time after publication, the rate of citations may decrease or increase gradually. This situation also depends on the popularity of the field discussed and the topic of the article itself. Research has shown that citation analysis in a particular area of knowledge correlates well with other scientific indexes, and this resource has achieved tremendous popularity results for measuring the impact of citations from countries, journals, articles, authors, specialties, or topics of disease or science<sup>4,5</sup>.

Scopus database are the most widely used tool for retrieving citation and related matrixes. The number of citations received by an article is a mark of distinction. Thus by recognizing 100 best-cited papers in a particular field can greatly help researcher and academicians to prioritize the bibliography for reference in the vast ocean of publications. Bibliometric studies have been carried out in various fields and also in dentistry on subjects endodontics<sup>6</sup>, orthodontics<sup>7</sup>, maxillofacial surgery<sup>8</sup>, but in oral biology fields never been discussed. The objective of the present study was to use these bibliometric resources to identify the 100 most cited articles published in the fields of oral biology and to analysis their principal characteristics. As we know, field of oral biology, never been discussed. Moreover, this study characteristics might inform update and progress in the oral biology.

## Materials and methods

### Data source

Scopus database was used to retrieve the data regarding the citation information of the published papers on Oral Biology. The data was accessed on 20<sup>th</sup> December 2020 and hence all the citations related matrixes were of this time point. The search used the medical term "Oral Biology" and this term was searched in the keywords, titles and text options of the Scopus database. TITLE-ABS-KEY (oral AND biology) AND ( LIMIT-TO ( SUBJAREA , "DENT" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ). The top 100 highly cited articles obtained from the search were then arranged according to the decreasing number of their citation counts. The relevancy of these articles to Oral Biology was evaluated by studying their titles and abstracts. There were no limitations for the time, language or type of articles.

### Data extraction

The previously used methodology was used in the present study for retrieval of relevant information from the articles<sup>9</sup>. Two independent authors evaluated all the selected articles. Any disagreement between the two authors was solved by consulting the third author. Collaboration among authors, countries and keywords co-occurrence network was developed using the VOSviewer software (Version 1.6.13; Leiden University).

## Results

Total 1277 articles were obtained from the search with h index and h index after excluding self-citations of 79 and 74 respectively. Based on the citations received, 100 most influential articles were sorted which account for 7,83% of the total articles obtained through the search (Supplementary file 1).

### Citation analysis

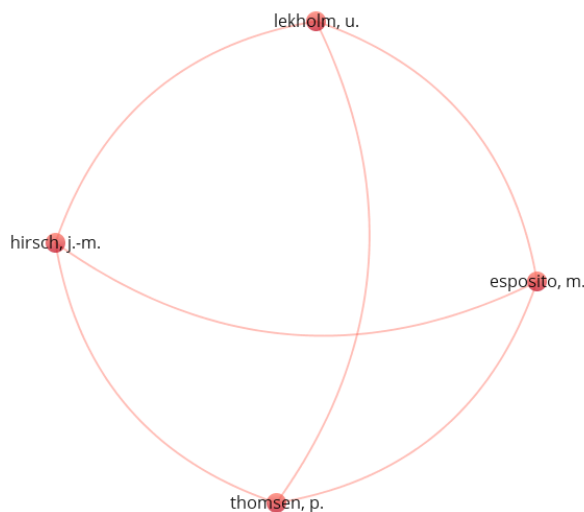
The 100 highly cited articles have received 18492 total citations. The number of citations ranged from 61 to 1825 (top article) with a mean of 184,92 (SD = 232,05) citations per article. More than 1800 citations were received by the articles titled "Critical review in oral biology & medicine: Factors affecting wound healing" (S. Guo and L.A. DiPietro, 2010). The overall h index and h index after removal of self-citations was 79 and 74 respectively. A

correlation analysis was performed between duration of publication and number of the citations received. There wasn't a significant correlation and the relationship between them was weak ( $r = 0,017$ ;  $p\text{-value} = 0,863$ ). The article with the highest citation density (182,5, nearly 183 citations annually) was an article of S. Guo and L.A. DiPietro, titled "Critical review in oral biology & medicine: Factors affecting wound healing" It was published in Journal of Dental Research in 2010<sup>10</sup>. The article that received the lowest citation density (0.97) was of N.S. Taichman et al, titled "Comparative studies on the biology of Actinobacillus actinomycetemcomitans leukotoxin in primates." It was published in Oral Microbiology and Immunology in 1987<sup>11</sup>.

### Journals analysis

From 32 different journals were associated with the 100 most cited articles (Table 1). Journal of Dental Research (29 articles) topped in total contribution followed by Oral Oncology (11 articles), Critical Reviews in Oral Biology and Medicine (6 articles) and Periodontology 2000 (6).

Out of 32, 17 journals contributed single article each. Among all the 32 journals, 18 were ranked in the first quartile, 5 in the second and 5 in the third category, and there was 4 journals have already discontinued. The Cite Score of the journals that published the 100 most cited articles ranged from 0,8 to 13,9 (mean  $4,59 \pm 2,76$ ). Majority (78%) of the top 100 articles were published in journals with Cite Score below 6.



**Figure 1.** Coauthor contribution with 2 or more articles with their network in the top-cited papers.

### Authors and countries of origin

Total 335 authors were associated with the 100 most cited papers. The analysis also showed that the selected articles had a minimum of 1 author ( $n = 18$ ) and a maximum of 11 authors ( $n = 1$ ). Total 18 papers had single author, 14 had two authors. And 22 and 12 papers involved the contribution of three and four authors, respectively; the rest of the 29 papers were contributed by five authors or more. Of these 100 most cited articles, 11 persons authored 2 of the 100 most-cited articles. A collaboration network was generated for the co-authors who contributed to 2 or more articles (Fig. 1).

The first author of each article was searched and their country was recorded. Based on this search, it was observed that investigators from the 20 different countries had contributed to the 100 most cited articles (Table 2).

### Type of document

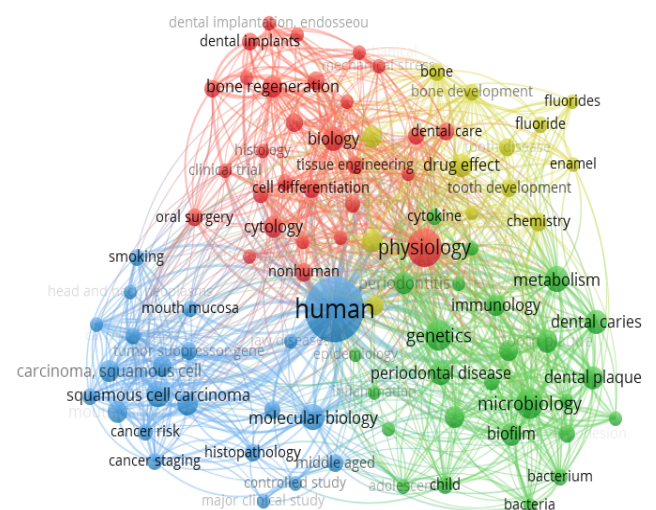
In terms of document type, 50 were articles, 2 conference papers and 48 reviews (Table 3).

### Funding sponsors and affiliations

From the analysis found that National Institute of Dental and Craniofacial Research funded 25 of the top 100 articles on Oral Biology Field (Table 4).

### Topic-wise analysis 100 best cited papers

Majority of the papers were related to General Dentistry (46) followed by Oral Surgery (13), that displayed in table 5.



**Figure 2.** Keywords co-occurrence network.

### Keywords analysis

A total 95 of selected keywords were identified. "Human" appeared 90 times followed by "Physiology" (31), "Microbiology" (21), "Genetics" (19) and "Metabolism" (15). A node size denotes the frequency of the keywords and the joining lines represent the total strength of the co-occurrence with other keywords (Fig. 2).

### Discussion

Dentistry is a multidisciplinary field that has made great advances in science or technology in recent years. Advances in dentistry also have an impact on the development of published articles from various countries. In dental articles, one of the most important forms of article reporting in a particular field is citation analysis. Bibliometric tools are used by many researchers to explore both clinical and molecular sciences and can use various ways, one of which is the analysis of citations from an article<sup>12</sup>.

Articles that are heavily cited as articles with good activity, and these authors have an impact on the field of knowledge. Another factor used for evaluation is the impact of journals and quartiles that have begun to be adopted for research in various fields. The quartile rank is calculated for each journal in each subject category according to the journal quartile that distributes the impact factor for that subject category. The number of publications share of the total publications in a given quartile, usually the first quartile (Q1), can play an important role in performance-based for public research<sup>13,14</sup>.

This decade, writers as well as scientists have started to choose their publication goals to collect citations or now there is a tendency to submit quality articles to journals with the highest impact factors. The dominance of the first quartile is 56% and has a high impact factor. Authors usually choose high-impact journals for their research publications. Journals with a high impact factor will also be interested in the publication of high quality papers<sup>15</sup>. This fact is evidenced by previous bibliometric studies which showed a positive between citation frequency and impact factor<sup>16</sup>.

This author, and scientist can serve as a yardstick to measure the trajectories of other researchers. Studies show that the true impact of a study is not only evaluated through the results

of the study, but also how many citations can be obtained from articles that have been published. This situation is different from the previous decade, where the trend is that older articles are usually quoted more frequently, regardless of the impact. It is this decade to prove that even new articles are capable of having an impact and are being cited more even though publication is still in recent trouble<sup>17,18</sup>.

Another contributing factor is that some relevant articles published before the internet decade will not be traced, because there is no electronic version of the document. This factor of course severely limits the access. From the analysis, it was found that articles with content that were widely followed were basic research. Basic research may be used as a reference and citation because it has sufficiently broad information that it can be quoted by various fields of dentistry. Furthermore, another dominance is that articles that are just discussed then become popular and begin to reduce the topic for research. An important factor in this research also determines the articles cited<sup>19,20</sup>.

Apart from that, the country of origin of the article was also observed in the field of oral biology. Countries with better economies are dominant in this area. This situation occurs because of the large amount of funding and performance both on molecular publications, quality and quantity<sup>21,22</sup>. The dominant countries in this field are Europe and the United States. In addition, articles tend to cite more often than usual research articles even if there is not much difference. Studies show that existing citations pay more attention to the suitability of the field and research than the type of article. However, review articles have more information and are therefore quoted more frequently in other articles<sup>23,24</sup>.

### Conclusions

So far, this article is the first in the field of oral biology to address the most cited articles. There is a predominance of review articles with authors from European and US countries. In addition, in this decade, the most cited journals are those with high impact factors and high quartiles as well. Funding also describes the number of articles published in the field of oral biology. It is hoped that this research will serve as an important source of information for

researchers, academics, and students.

### Declaration of Interest

The authors report no conflict of interest.

NO	Journal Name	Cite Score (2019)	Quartile (2019)	Categories	Number of Articles
1	Journal of Dental Research	9	1	General Dentistry	29
2	Oral Oncology	6	1	Oncology	11
3	Critical Reviews in Oral Biology and Medicine	#N/A	#N/A	#N/A	6
4	Periodontology 2000	13,9	1	Periodontics	6
5	Journal of Oral and Maxillofacial Surgery	2,8	2	Oral Surgery	5
6	Oral Diseases	3,9	1	General Dentistry	4
7	Clinical Oral Implants Research	7,5	1	Oral Surgery	3
8	European Journal of Oral Sciences	3,3	1	General Dentistry	3
9	International Journal of Oral and Maxillofacial Surgery	3,7	1	Surgery	3
10	Oral Microbiology and Immunology	#N/A	#N/A	#N/A	3
11	British Journal of Oral and Maxillofacial Surgery	2	2	Oral Surgery	2
12	Caries Research	4,5	1	General Dentistry	2
13	Journal of Clinical Periodontology	7,4	1	Periodontics	2
14	Journal of Oral Rehabilitation	3,8	1	General Dentistry	2
15	Monographs in oral science	0,8	3	General Dentistry	2
16	Cleft Palate-Craniofacial Journal	2	3	Oral Surgery	1
17	Community Dentistry and Oral Epidemiology	4,1	1	Public Health, Environmental and Occupational Health	1
18	Dental clinics of North America	3,5	1	General Dentistry	1
19	Dental Materials	8	1	General Dentistry	1
20	Journal of Adhesive Dentistry	3,6	2	Periodontics	1
21	Journal of dental education	2,1	2	Education	1
22	Journal of Dentistry	5,8	1	General Dentistry	1
23	Journal of Endodontics	6,2	1	General Dentistry	1
24	Journal of Maxillofacial and Oral Surgery	1,2	3	Oral Surgery	1

25	Journal of Oral Microbiology	4,5	1	Dentistry (miscellaneous)	1
26	Journal of Oral Pathology & Medicine	#N/A	#N/A	#N/A	1
27	Journal of Oral Pathology and Medicine	4,2	3	Cancer Research	1
28	Journal of Periodontal Research	5,1	2	Periodontics	1
29	Journal of Periodontology	5,2	1	Periodontics	1
30	Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics	#N/A	#N/A	#N/A	1
31	Orthodontics and Craniofacial Research	1,7	3	Oral Surgery	1
32	Progress in Orthodontics	2,9	1	Orthodontics	1

**Table 1.** Analysis Results of Journal in the fields of Oral Biology.

No	Name of Author	First Author	Co-author	Last Author	Total
1	I. van der Waal	2			2
2	M. Esposito	2			2
3	J.-M. Hirsch		2		2
4	S. Offenbacher		2		2
5	U. Joos		2		2
6	U. Lekholm		2		2
7	C.A.G. McCulloch		1	1	2
8	D.H. Pashley			2	2
9	J.A. Califano			2	2
10	P. Thomsen			2	2
11	W.V. Giannobile			2	2

**Table 2.** Authors with at least 5 articles included in the top 100 cited papers onin the fields of Oral Biology.

Item	Description	Number of Articles
Year-wise distribution of papers	1980s	2
	1990s	12
	2000s	50
	2010s	36
Country of Origin (Publisher)	Netherlands	25
	Switzerland	4
	UK	4
	US	56
Country of Origin (First Author)	US	52
	Switzerland	6
	UK	6
	Brazil	5
	Australia	4
	Sweden	4
	Canada	3

	Germany	3
	Netherlands	3
	India	2
	Japan	2
	Norway	2
	China	1
	Denmark	1
	France	1
	Israel	1
	Italy	1
	New Zealand	1
	South Korea	1
	Taiwan	1
Type of document	Article	50
	Conference Paper	2
	Review	48

**Table 3.** Characteristics of Journal in the fields of Oral Biology.

No	Funding Institution	First Funding Institution	Co- Funding Institution	Total
1	National Institute of Dental and Craniofacial Research	20	5	25
2	National Institutes of Health	7		7
3	Deutsche Forschungsgemeinschaft	3		3
4	National Cancer Institute	3		3
5	Sao Paulo Research Foundation	1	2	3
6	National Council for Scientific and Technological Development	1	1	2
7	Amgen, Inc	1		1
8	Bangladesh Council of Scientific and Industrial Research	1		1
9	Brazilian Development Bank	1		1
10	Conselho Nacional de Desenvolvimento Científico e Tecnológico	1		1
11	Health Research Council of New Zealand	1		1
12	ITI Foundation for the Promotion of Implantology	1		1
13	Japan Society for the Promotion of Science	1		1
14	National Center for Research Resources	1		1
15	National Heart, Lung, and Blood Institute	1		1
16	National Institute of Allergy and Infectious Diseases	1		1
17	National Nature Science Foundation of China	1		1
18	National Science Foundation	1		1
19	National Taiwan University	1		1

20	South East England Development Agency	1		1
21	Weathermax Foundation	1		1
22	Biomodels, LLC		1	1
23	Department of Biotechnology, Government of West Bengal		1	1
24	National Institute of General Medical Sciences		1	1
25	National Science Council of Taiwan		1	1
26	Raumedic		1	1
27	University of Michigan Comprehensive Cancer Center		1	1

**Table 4.** Funding and Affiliation of Article in Oral Biology.

Topic	Original Research	Review	Conference Paper	Total
General Dentistry	21	24	1	46
Oral Surgery	10	3		13
Periodontics	7	3	1	11
Oncology	4	7		11
#N/A	4	7		11
Surgery	2	1		3
Dentistry (miscellaneous)	1			1
Public Health, Environmental and Occupational Health	1			1
Cancer Research		1		1
Education		1		1
Orthodontics		1		1

**Table 5.** Topic-wise analysis 100 best cited papers.

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