



Original Article

Bibliometric analysis of the top-100 cited articles on oral potentially malignant disorders to guide research topic and direction



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Abstract *Background/purpose:* Bibliometric analysis highlights the key topics and studies which have shaped the understanding and management of a concerned disease. Here the top-cited articles on oral potentially malignant disorders (OPMD) were characterized and analyzed.

Materials and methods: A comprehensive search was performed and identified in the Scopus database from 1941 to 10 March 2019 for the 100 most-cited articles on OPMD.

Results: The number of citations of the 100 selected articles varied from 131 to 1422, with a mean of 240.6 citations per article. Molecular markers/targets, chemoprevention, and early detection and diagnosis of oral cancer were the top-3 study topics, and the proportion of the number of the articles on the top-3 topics and that of the number of citations was 47% and 47.7%, respectively. Moreover, 20 (90.9%) of the 22 high-quality articles published in journals with high IF > 9 were the research of top-3 topics. Besides, the most contributing author, Hong WK (n = 11), was from the most contributing institution and country of origin, M.D. Anderson Cancer Center (n = 12), United States (n = 41). Systematic reviews (n = 7), randomized controlled trial (n = 5), cohort studies (n = 18) were study designs with higher evidence level, but the large majority (n = 70) were considered lower level.

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Conclusion: The results of this first citation analysis of the 100 most-cited articles on OPMD provide a historical perspective and key topics, and suggest a troika for the trends of further research and clinical practice in the field of OPMD.

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Introduction

Oral potentially malignant disorders (OPMD), formerly known as oral premalignant/precancerous lesions, describes a recognizable group of oral mucosal diseases that have a significantly increased risk of progressing to oral cancer.¹ Currently, preference is given to the term 'potentially malignant' instead of the terms 'pre-malignant and precancerous', was recommended at a workshop of the WHO Collaborating Centre held in 2005.¹ It is a more precise term because there is no certainty that all precancerous lesions will eventually develop into cancer.^{1,2} Clinically, oral leukoplakia, erythroplakia, submucous fibrosis, lichen planus are individual disorders of OPMD.³ Epithelial dysplasia is the histologic feature and indicator of OPMD progressed to oral cancer.⁴ The etiology of OPMD is quite complex, and the management remains a great challenge.⁵ Therefore, the research significance of OPMD is highly regarded in the field, and increasingly large number of articles on OPMD have been published.⁶

Bibliometric analysis highlights the key topics and studies which have shaped the understanding and management of a disease of interest.⁷ Citation analysis is the area of bibliometrics that utilizes citation data to evaluate the academic influence of an article in its particular field.⁸ It is a definitely useful tool that the frequency and pattern of citations are objective parameters for evaluating the scientific performance within the designated area.⁸ The topics, study design, and levels of evidence-based medicine (EBM) of highly cited articles may influence the trends in clinical practice and further research.^{9–11} The number of citations of an article usually indicates the interest of the researchers on using the data to perform their own studies. A bibliometric analysis enables researchers to identify study hotspots and to explore the updated insights into a particular field. In addition, citation rating of articles significantly recognizes authors, institutions and countries of origin, and journals within a particular scientific community.^{7,8}

Although top-cited articles and citation analyses of oral cancer,¹² leukoplakia/erythroplakia,¹³ and submucous fibrosis¹⁴ were reported, the analyses of research trends and key topics were neglected. Moreover, lack of other individual disorders such as lichen planus and histologic nomenclature dysplasia are analyzed. In the present study, we therefore identified the top-100 most cited articles on general OPMD including individual disorders and dysplasia, and analyzed the bibliometric characteristics and research trends of OPMD.

Materials and methods

Data source

As per the Foy et al.¹³ and Gondivkar et al.¹⁴ method, we used the Scopus citation index to obtain citation information about published articles on OPMD. Using the search strategy described as follows, *TITLE-ABS (oral) AND TITLE-ABS (potentially malignant) OR TITLE-ABS (pre-malignancy) OR TITLE-ABS (precancer) OR TITLE-ABS (pre-cancerous) OR TITLE-ABS (pre-malignant) OR TITLE-ABS (preneoplasia) OR TITLE-ABS (preneoplasitic) OR TITLE-ABS (pre-malignancy) OR TITLE-ABS (pre-malignant) OR TITLE-ABS (pre-cancer) OR TITLE-ABS (pre-cancerous) OR TITLE-ABS (pre-neoplasia) OR TITLE-ABS (pre-neoplasitic) OR TITLE-ABS (intraepithelial neoplasia) OR TITLE-ABS (dysplasia) OR TITLE-ABS (dysplasitic)*, we searched in the Scopus database up to 10 March 2019. There was no restriction in the search regarding publication year, language, or study design and type of the articles. With the mentioned search strategy, 8029 articles on OPMD were published since its inception in 1941. The articles were categorized in descending order based on their number of citations. Titles and abstracts or full texts of these articles were screened and reevaluated to assure their relevance to OPMD. In cases of articles with the same number of total citations, the articles with highest citation density (citations per year) were positioned higher in the ranking.

Data extraction

A list of top-100 articles was created by sorting among all the retrieved articles according to the number of citations in descending order. All the articles were reviewed and recorded the following information: authorship, publication title, publication year, number of citations, citation density, journal and its impact factor (IF, 2017 Journal of Citation Reports (JCR): Science Edition), institution and country of origin of the first author, study type, study design, and level of evidence. Articles were classified as primary research studies (epidemiological, basic, or clinical) or secondary research (narrative review, systematic review or meta-analysis). Study design was classified as clinical trial, cohort study, case-control study, cross-sectional study, case series, animal studies, and in vitro studies. As per the method used in previous studies on oral cancer and submucous fibrosis,^{12,14} the evidence level of the article was analyzed using the classification proposed

by the Oxford Centre for Evidence-Based Medicine (<http://www.cebm.net/index.aspx?o=5653>). Two independent authors (LM and XG) carried out the screening and subsequent analysis of the articles. In case of discrepancy, the opinion of a third author (WL) was requested to achieve consensus. This study did not require any human/animal subjects to acquire ethics committee approval.

Results

Characteristics of articles included

With the search strategy algorithm, 8029 articles on OPMD were searched in the Scopus database for the period 1941 to the time of the search. From the collection, the top 100 most cited articles published from 1966 to 2013 were identified and their various characteristics analyzed (Fig. 1). The total number of citations and that after removal of self-citations was 24066 and 22485, respectively. The overall h index and h index after removal of self-citations was both 100. The mean number of citations was 240.6, with a range of 131 (article rank No. 100) to 1422 (article rank No. 1). The whole information on ranking, author, title, year and journal of publication, number of citations, citation density, and journal IF of the top-100 articles on OPMD is shown in Supplemental Table S1. The number of articles on the top 100 list by decade of publication is shown in Fig. 1.

Topic and type of study, study design, and evidence level of the articles included

The topic, type of study, study design, and level of evidence-based medicine of the 100 most cited articles on OPMD is shown in Table 1. The top-3 study topics were molecular markers/targets (18 articles), chemoprevention (15 articles), early detection and diagnosis of oral cancer (14 articles); the corresponding number of citations was 3628, 5531, and 3029, respectively. The proportion of the number of the articles on the top-3 topics and that of the number of citations was 47% and 47.7%, respectively. There were 54 primary research articles, 39 narrative review

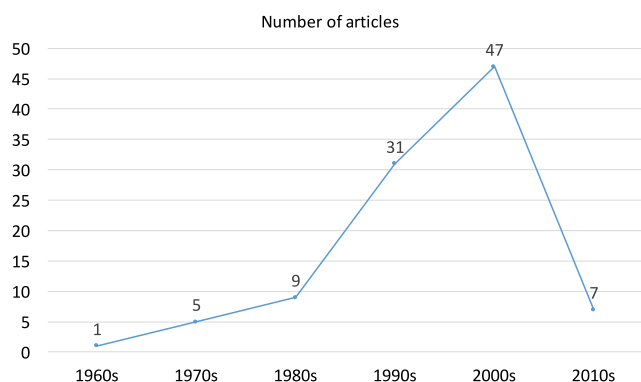


Figure 1 The number of top-100 cited articles on OPMD by decade of publication.

Table 1 Topic, type of study, study design, and level of evidence-based medicine of the 100 most cited articles on OPMD

Article topic and the type of study/ study design	No. of articles	Evidence level (EL)
Molecular markers/targets	18	
Case control	11	EL4
Cohort study	4	EL3
Case series	1	EL4
Narrative review	2	EL5
Treatment	18	
Chemoprevention		
Narrative review	3	EL5
Vitamin A, retinoid and beta-carotene		
Randomized controlled trial (RCT)	3	EL2
Cohort study	1	EL3
Narrative review	2	EL5
Natural products, eg. curcumin and tea		
Randomized controlled trial (RCT)	1	EL2
Cohort study	1	EL3
Basic research (animal study and in vitro)	4	EL5
Surgery: a cohort study	1	EL3
Photodynamic		
Case control	1	EL4
Narrative review	1	EL5
Early detection and diagnosis of oral cancer	14	
Narrative review	3	EL5
Spectroscopy		
Case control	5	EL4
Basic research (animal study)	1	EL5
Narrative review	1	EL5
Oral brush biopsy: RCT	1	EL2
Systematic review	3	EL1
Follow-up outcome	12	
Cohort study	11	EL3
Systematic review and meta-analysis	1	EL1
Etiology and risk factors	11	
Betel quid chewing, tobacco and alcohol use, etc		
Narrative review	5	EL5
Systematic review	1	EL1
Case control	1	EL4
Human papillomavirus		
Systematic review/meta-analysis	2	EL1
Narrative review	1	EL5
Case control	1	EL4
Narrative review of comprehensive knowledge	18	
General OPMD	5	EL5
Oral leukoplakia	1	EL5
Oral lichen planus	9	EL5
Oral submucous fibrosis	3	EL5

(continued on next page)

Table 1 (continued)

Article topic and the type of study/ study design	No. of articles	Evidence level (EL)
Epidemiology		
Cross-sectional	3	EL4
Narrative review	1	EL5
Utility and subjectivity of oral dysplasia		
Case control	2	EL4
Narrative review	1	EL5
Animal model of oral carcinogenesis: a narrative review and an animal study		
	2	EL5

articles, and 7 systematic review or meta-analysis articles. The study design of molecular markers/targets was principally case control (11 articles) and cohort studies (4 articles). The study design of chemopreventive drugs was principally randomized controlled trial (RCT, 4 articles) and cohort studies (2 articles). The study design of early detection and diagnosis and follow-up outcome was principally case control (5 articles) and cohort studies (11 articles), respectively. With regard to the evidence level, only 7 systematic review or meta-analysis articles and 5 RCT articles were considered evidence level 1 and 2, respectively. The 18 cohort studies were considered evidence level 3, and the other 70 articles were considered lower level.

Authors, institution and country of origin, and journal of publication

The most influential authors, institutions and countries of origin within a particular scientific community are often recognized in the most cited articles. The top-4 contributing authors were Hong W.K. (11 articles), van der Waal I. (10 articles), Lippman S. (8 articles), and Warnakulasuriya S. (6 articles). The detailed information on authors with at least 4 articles included in the 100 most cited articles was showed in Table 2. The top-5 contributing countries were United States (41 articles), United Kingdom (18 articles), Netherlands (9 articles), Denmark (6 articles), and India (5 articles). The top-3 contributing institutions were M.D. Anderson Cancer Center (13 articles), Academic Centre for Dentistry Amsterdam (8 articles), and King's College Dental Institute (6 articles). The detailed information on countries and their institutions of origin with at least 2 articles of the 100 most cited articles showed in Table 3.

The top 100 articles were published in different scientific 41 journals. The journal of publication with largest number was Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology (12 articles), followed by Oral Oncology (11 articles), Journal of Oral Pathology and Medicine (10 articles), and Cancer Research (8 articles). The detailed information on period of publication, the name and IF of the journals with at least 3 articles in the most cited articles showed in Table 4. It is particularly noteworthy that a narrative review articles on oral cancer with emphasis on the importance of early diagnosis were published on CA: A Cancer Journal for Clinicians (IF = 244.585, 2017 JCR).

Table 2 Authors with at least 4 articles included in the 100 most cited articles on OPML

Rank	Name	First Author	Coauthor	Last Author	Total
1	Hong WK	1	5	5	11
2	van der Waal I	2	0	8	10
3	Lippman S	4	3	1	8
4	Warnakulasuriya S	4	1	1	6
5	Scully C	3	1	1	5
6	Pindborg JJ	1	3	1	5
7	Reibel J	2	3	0	5
8	Van Der Meij EH	3	2	0	5
9	Hittelman WN	0	3	2	5
10	Holmstrup P	2	2	0	4
11	Mao L	1	2	1	4
12	Lee JJ	1	3	0	4
13	Schepman KP	1	3	0	4

Moreover, 2 RCT article on chemopreventive drug published on New England Journal of Medicine (IF = 79.258, 2017 JCR).

Discussion

Bibliometric analysis helps in evaluating the research trends and key topics in the targeted field which has undergone changes over the decades.^{9–11} It is well known that both impact factor (IF) of publication journal and citation rating of an article are the major determinants for evaluating the influence of an article.¹⁵ It has been suggested that classic papers are these that labeled articles achieving more than 100 citations.^{16,17} The knowledge and understanding of these classic papers can provide extra insights into better understanding of the concerned field and help guide the education.^{9–11} To the best of our knowledge, there is not available report concerning citation of articles on nomenclature OPMD in literature. This is the first study that evaluated the characteristics and research trends of the 100 most cited articles on OPMD including dysplasia.

All the articles included in this bibliometric analysis on OPMD can be considered classic, since the number of citations with at least 131. Although the citation count does not indicate the scientific value of an article, it does represent its impact in the advancement of the respective research or clinical area and the number of researchers associated with their concerning field.^{9–11} Journals with high IF are attracted by authors in selecting for their high-quality papers, whereas specialty journals are also selected to publish their high-quality articles over general medical journals.¹⁶ In the present study, we noted that 22 of 100 most cited articles were published in 8 journals with high IF > 9, namely CA: A Cancer Journal for Clinicians, New England Journal of Medicine, Lancet Oncology, Nature Medicine, Journal of Clinical Oncology, Annals of Oncology, Clinical Cancer Research, Cancer Research. Besides, 78 articles were published in 33 journals with IF < 9; the journals with most articles (rank 1–3) were the specialty journals, namely Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology (n = 12), Oral Oncology

Table 3 Countries and their institutions of origin with at least 2 articles of the 100 most cited articles on OPML

Rank	Country with at least 2 articles	No. of articles total n=92	Institution with at least 2 articles	No. of articles total n=55
1	United States	41	M.D. Anderson Cancer Center, University of Texas, Houston National Cancer Institute, Bethesda, Maryland School of Dentistry, University of California, San Francisco Johns Hopkins Medical Center, Baltimore Department of Oral Health Practice, University of Kentucky, Lexington	13 2 2 2 2
2	United Kingdom	18	King's College Dental Institute, Denmark Hill Campus, London Eastman Dental Institute, London School of Dentistry, The University of Manchester, Manchester Department of Surgery, National Medical Laser Centre, London	6 3 2 2
3	Netherlands	9	Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam	8
4	Denmark	6	School of Dentistry, University of Copenhagen, Copenhagen Royal Dental College, Copenhagen	4 2
5	India	5	Tata Memorial Centre, Mumbai	3
6	Japan	4	First Department of Pathology, Gifu University School of Medicine	2
7	Canada	3	British Columbia Cancer Agency, Vancouver	2
8	Finland	2		
	China (Taiwan)	2		
	Germany	2		

Table 4 Journals with at least 3 articles in which the 100 most cited articles on OPML were published

Rank	Journal (abbreviated name)	Impact factor (2017 JCR)	No. of articles total n=65	Period of publication (No. of articles)
1	Oral Surg Oral Med Oral Pathol Oral Radiol	1.718	12	1960s (1), 1970s (2), 1980s (1), 1990s (4), 2000s (3)
2	Oral Oncol	4.636	11	1990s (2), 2000s (8), 2010s (1)
3	J Oral Pathol Med.	2.237	10	1970s (1), 1980s (2), 1990s (3), 2000s (4)
4	Cancer Res	9.13	8	1990s (6), 2000s (2)
5	Clin Cancer Res	10.199	5	2000s (5)
6	Cancer	6.537	4	1970s (1), 1980s (1), 1990s (1), 2000s (1)
7	New Engl J Med.	79.258	3	1990s (2), 2000s (1)
	J Clin Oncol	26.36	3	1990s (2), 2000s (1)
	J Am Dent Assoc	2.486	3	1990s (1), 2000s (1), 2010s (1)
	Oral Dis	2.31	3	2000s (2), 2010s (1)
	Community Dent Oral Epidemiol	1.992	3	1980s (2), 2000s (1)

(n = 11), and Oral Pathology and Medicine (n = 10). This demonstrates that the researchers follow these 3 journals most frequently for achieving information on OPMD.

All the articles included in this analysis were published in English language. Hong W.K. (11 articles, rank No. 1) and Lippman S. (8 articles, rank No. 3) from the most contributing institution, M.D. Anderson Cancer Center, University of Texas (13 articles), stood out top in the rank on the list. The majority of articles included were published by authors and institutions in the United States (n = 41), in agreement with the results of a relevant study on oral cancer.¹² United States has a strong influence on research in the health sciences; this can be attributed to the high level of financial grant support given to research in that country and a large number of American researchers.¹² Indeed, the United States is the leading country for medical research

publications. The followed contributing countries of origin were European countries, United Kingdom, Netherlands, and Denmark.

In this bibliometric analysis, we focused on the analysis of the topic, type of study, study design, and level of EBM of the 100 most cited articles on OPMD, so as to guide the trends in future research and clinical practice. In recent era, great importance has been given to EBM, and efforts are being made to improve the quality of research.¹⁸ However, the large majority of the most cited articles in the field of OPMD had a low evidence level, and minority of these articles, 7 systematic reviews/meta-analyses and 5 RCTs, had a high evidence level. It is noteworthy that the topics of the RCTs were the research of chemopreventive drugs (4 RCTs) and early detection and diagnosis (1 RCTs). Moreover, 20 (90.9%) of the mentioned 22 articles published

in journals with high IF > 9 were the research of top-3 topics: molecular markers/targets of oral carcinogenesis, chemoprevention, and early detection/diagnosis. These emphasize the impact of the 3 topics of the articles, their quality and their relevance to further research and clinical practice.

The largest number of the 3 most cited articles classified by topic were the molecular markers/targets, chemoprevention, and early detection/diagnosis, which may reflect the most important and concerned topics of OPMD research. First, The molecular markers/targets could identify high-risk early lesions and provide for development of molecular-targeted drugs of oral cancer prevention.¹⁹ Loss of heterozygosity (LOH) at chromosome 3p or 9p should be the most valuable molecular marker for risk assessment of oral cancer development, because LOH was considered higher evidence level form cohort studies than other markers. Secondly, the majority of chemopreventive studies were vitamin A, retinoid and beta-carotene, which had been demonstrated to be ineffective in reducing the long-term risk of oral cancer in a large chemoprevention trial.²⁰ Increasing evidence indicates that natural products, eg. curcumin and tea, have preliminary effectiveness. Unfortunately, no evidence of a treatment is currently demonstrated to be effective for preventing the malignant development of OPMD.²¹ Arguably, progress in the prevention and treatment of oral carcinogenesis will require improved understanding of the underlying molecular mechanisms, facilitating the discovery of diagnostic, prognostic, and predictive markers, as well as the identification of novel targeted therapeutics. Thirdly, it's an obvious fact that early detection and diagnosis of high-risk OPMD is a high priority for reducing both morbidity and mortality of oral cancer.⁵ There is evidence that a visual examination as part of a population-based screening programme reduces the mortality rate of oral cancer in high-risk individuals; but there was no evidence to support the use of adjunctive technologies like toluidine blue, brush biopsy or fluorescence imaging as a screening tool to reduce oral cancer mortality.²²

We are aware of certain limitations in this bibliometric analysis, although we attempted to minimize the potential defects. First, we used only Scopus database not do other different databases for analysis, because the advantage of Scopus database can automatically exclude self-citing. And Scopus provides about 20% more coverage than Web of Science, whereas Google Scholar provides results of more inconsistent accuracy.^{23,24} Secondly, citation count does not directly reflect quality of an article but enable a quantitative evaluation of the scientific impact of an article in a designed field. Authors tend to cite previous highly cited articles independently of content and quality through snowball effect. Thirdly, there is definite time effect in bibliometric analysis, but we have calculated citation density of each article which explains their scientific impact annually.

In conclusion, the current study for the first time reported the characteristics of the top-100 most cited articles on OPMD. The results of this study not only provide a historical perspective on scientific evolution but also reveal trends in further research and clinical practice in the field of OPMD. We believe that the list of top-cited articles

presented herein will definitely be the important source information for researchers and clinicians. We hope that the recent era of EBM will influence the quality of articles in OPMD research.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2019.09.011>.

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