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Original Article

# A scientometric study of oral cancer research in South and Southeast Asia with emphasis on risk factors control

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## KEYWORDS

Bibliometrics;  
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Oral squamous cell carcinoma;  
Research characteristics;  
Risk factors

**Abstract** *Background/purpose:* South Asia and Southeast Asia are the regions with relatively high and increased disease burden of oral cancer. The purpose of this study was to analyze the scientometric characteristics of oral cancer research in these regions.

*Materials and methods:* There are 8 countries from South Asia and 11 countries from Southeast Asia. All the articles on oral cancer from these countries were retrieved in the Scopus database.

*Results:* A total of 5660 articles originated from South Asia (n = 4718) and Southeast Asia (n = 942). India (n = 4302; 91.2%) was the country publishing most articles on oral cancer in South Asia, and Malaysia (n = 355; 37.7%) was first in Southeast Asia. Tobacco smoking, alcohol consumption, and areca nut as risk factors were common keywords, attention should be paid to them while developing policies for oral cancer control. In India, the most topic including distinctive keywords was diagnostics (sensitivity/specificity, saliva, and predictive value), followed by molecular biology (antioxidants, lipid peroxidation, and glutathione),

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experimental in vivo (hamster and cheek pouch), and risk factor (smokeless tobacco). In Malaysia, the most topic containing keywords was molecular biology followed by epidemiology and drug research.

**Conclusion:** This study for the first time reported the scientometric characteristics of oral cancer research in South Asia (India) and Southeast Asia (Malaysia). It is essential to improve the public awareness of risk factors control to reduce the oral cancer burden, especially in low-and middle-income countries.

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## Introduction

Oral cancer is a major cause of cancer morbidity and mortality worldwide. Risk factors associated with oral cancer are smoking, alcohol, betel quid (areca nut) use, ultraviolet sunlight (for lip), human papillomavirus (HPV), poor oral hygiene, and genetic alterations.<sup>1</sup> Of these, tobacco and alcohol use are commonly recognized as substantial risk factors for oral cancer, and quitting smoking and drinking have reported to significantly reduce the risk of oral cancer.<sup>2</sup> Moreover, betel quid is chewed by approximately 600 million individuals globally, most of whom live in the South Asia, Southeast Asia, and Taiwan and mainland (mainly Hunan and Hainan provinces) of China, and Pacific islands.<sup>3</sup> Owing to differences in geographical environment, the dietary and lifestyle habits, and the degree of economy, the disease burden of oral cancer is of noticeable geographical heterogeneity.<sup>4</sup> The incidence of oral cancer worldwide presented an overall slightly decreasing trend and an increasing trend in the local regions, especially in South and Southeast Asia, which are the regions with relatively high and increased disease burden.<sup>5</sup>

Bibliometrics is a useful tool that utilizes scientometric and citation data to assess scientific output within the designated area.<sup>6–8</sup> Publication, as a central part of scientific research, is an important indicator of research output. Scientometric overview of publications on a disease is often conducted to recognize study hotspots and investigate latest trends in specific research fields.<sup>6–9</sup> Owing to differences in the degree of economy and disease burden of geographical heterogeneity, there should be different scientific output of oral cancer research in different countries/regions. Also, due to differences in lifestyle habits and genetic alterations, the scholars from different countries/regions also could have different research concerns regarding the same disease. After analysis of oral cancer research in Taiwan and mainland of China,<sup>9</sup> we further analyze the scientometric characteristics of oral cancer research in South and Southeast Asia (SEA).

## Materials and methods

The list of the SEA countries/regions focused on this issue of oral cancer research was defined in [supplementary Table S1](#). As per the methodology described previously,<sup>9</sup> the

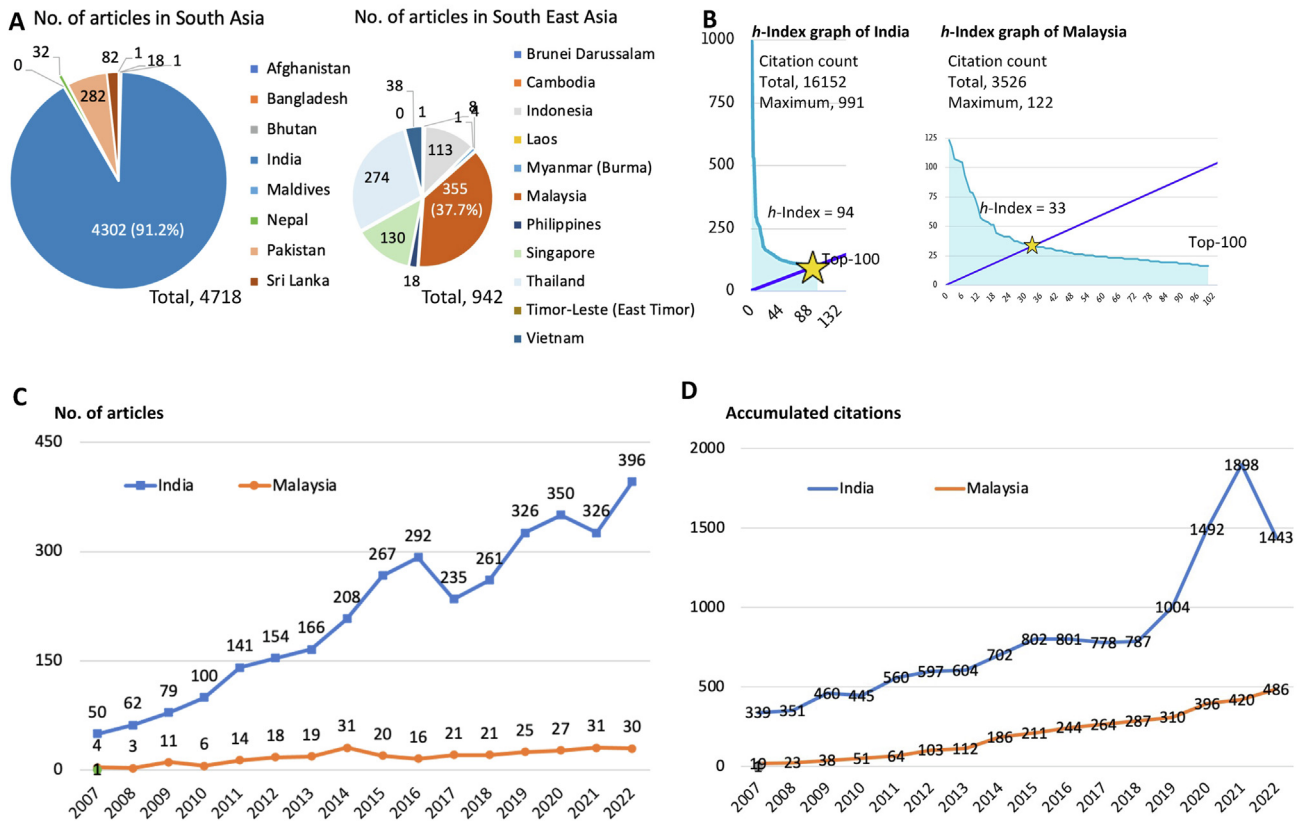
articles on oral cancer from the SEA countries were retrieved on 30 Aug 2023 in the Scopus database according to the search strategy ([Table S2](#)). We used medical subject terms “oral” and “cancer” and the synonyms in the Title, and selected the name of the relevant SEA countries in the filter of Country/Region. Then, “Article” in the filter of Document type and “English” in the filter of Language were included. Only original article was included since this type of publications substantially reflects original research, and only English literature was included because it is an international knowledge-exchange language.

The scientometric characteristics of all the eligible articles were reviewed and recorded for the following information: title, keyword, citation count, publication year, journal of publication, authorship, affiliation, and country/region of origin. Data search and extraction were performed independently by two investigators, and any discrepancy of results was resolved in a consensus symposium. Based on the results of literature search, the researchers from India and Malaysia contributed the most articles on oral cancer among 8 countries from South Asia and 11 countries from Southeast Asia, respectively. To be of comparability of scientific influence of the academics among different areas, the top-100 most-cited articles from India and Malaysia were retrieved and compared in this analysis. Bibliometrix Biblioshiny R-package software (K-Synth Srl Inc., Naples, Italy) was used to analyze the relevant bibliometric data.

## Results

### Citation characteristics

With the search strategy algorithm, a total of 5660 articles originated from South Asia ( $n = 4718$ ) and Southeast Asia ( $n = 942$ ). As presented in [Fig. 1A](#), India ( $n = 4302$ ; 91.2%) was the country publishing most articles on oral cancer among 8 countries from South Asia, and Malaysia ( $n = 355$ ; 37.7%) was first among 11 countries from Southeast Asia. To assess academic influence of the representative articles, the most-cited top-100 articles that originated from India and Malaysia were retrieved ([Fig. 1B](#)). The total citation count was 16,152 and the  $h$  index was 94 for articles from India, and the total count was 3526 and the  $h$  index was 33 for articles from Malaysia. To further concretize the trends of scientific output in the representative country, we



**Figure 1** Citation characteristics of the articles on oral cancer. (A) Detailed numbers of the articles originated from 8 countries in South Asia and 11 countries in Southeast Asia. (B) The *h*-Index graphs of the most-cited top-100 articles from India and Malaysia. (C) The annual number of the articles during 2007–2022. (D) The accumulated citations of the most-cited top-100 articles during 2007–2022.

assessed the annual number of the articles (Fig. 1C) and accumulated citation count of the most-cited top-100 articles (Fig. 1D) during 2007 to 2022. In India, the annual number of articles stably raised from 50 to 396 during 2007–2022, and the accumulated citations of the top-100 articles increased from 339 to 1443 during this period. In Malaysia, the annual number of articles stably rose from 4 to 30 during 2007–2022, and the accumulated citations of the top-100 articles increased from 19 to 486 during this period.

### Bibliometric characteristics

The cloud graphs of journal names, contributing authors, institutions of origin are shown in Fig. 2. The detailed information on publication year, authors, title, journal of publication, citation count, and keywords of these top-100 articles are presented in supplementary Tables S3 and S4. The journal of publication, contributing authors, and institutions of origin with largest number of articles (rank, 1–10) are presented in Table S5. In India, the journal of publication, contributing author, institution of origin with largest number of articles was Journal of Oral & Maxillofacial Pathology ( $n = 256$ ), Nagini, S. ( $n = 87$ ), and Tata Memorial Hospital ( $n = 338$ ), respectively. In Malaysia, the journal of publication, contributing author, institution of origin with maximum number was Asian Pacific Journal of

Cancer Prevention ( $n = 30$ ), Zain, R.B. ( $n = 75$ ), and Universiti Malaya ( $n = 185$ ), respectively.

### Research characteristics

Based on the frequency of keywords in all included articles on oral cancer, the keywords were automatically recognized in the order of highest to lowest frequency in the database. For oral cancer related disorders, squamous cell carcinoma, tongue neoplasms, head and neck neoplasms were common in the articles. For study design, controlled study, retrospective study, animal experiment, and case–control study were common; while randomized controlled trial (RCT) was not common in these regions. The cloud graphs of research keywords retrieved in the articles from India and Malaysia are shown in Fig. 3A. The same common keywords were pathology, protein expression, immunohistochemistry, genetics, metabolism, apoptosis, prognosis, and lymph node metastasis (Fig. 3B). We highlight the analysis of distinctive research keywords (Fig. 3C). In India, the most topic including distinctive keywords was diagnostics ( $n = 395$ ; sensitivity & specificity, saliva, and predictive value), followed by molecular biology ( $n = 355$ ; antioxidants, lipid peroxidation, and glutathione), experimental in vivo ( $n = 216$ ; hamster and cheek pouch), and risk factor ( $n = 125$ ; smokeless tobacco). In Malaysia, the most topic containing keywords was molecular biology



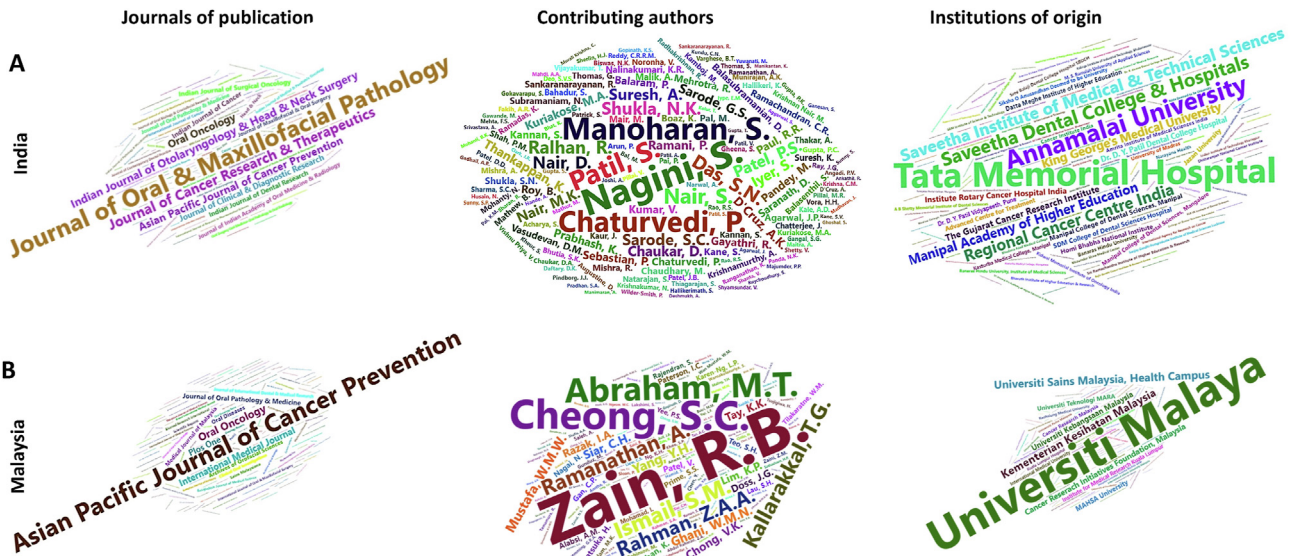


Figure 2 Cloud graphs of journal of publication, contributing authors, and institutions of origin regarding oral cancer research in (A) India and (B) Malaysia.

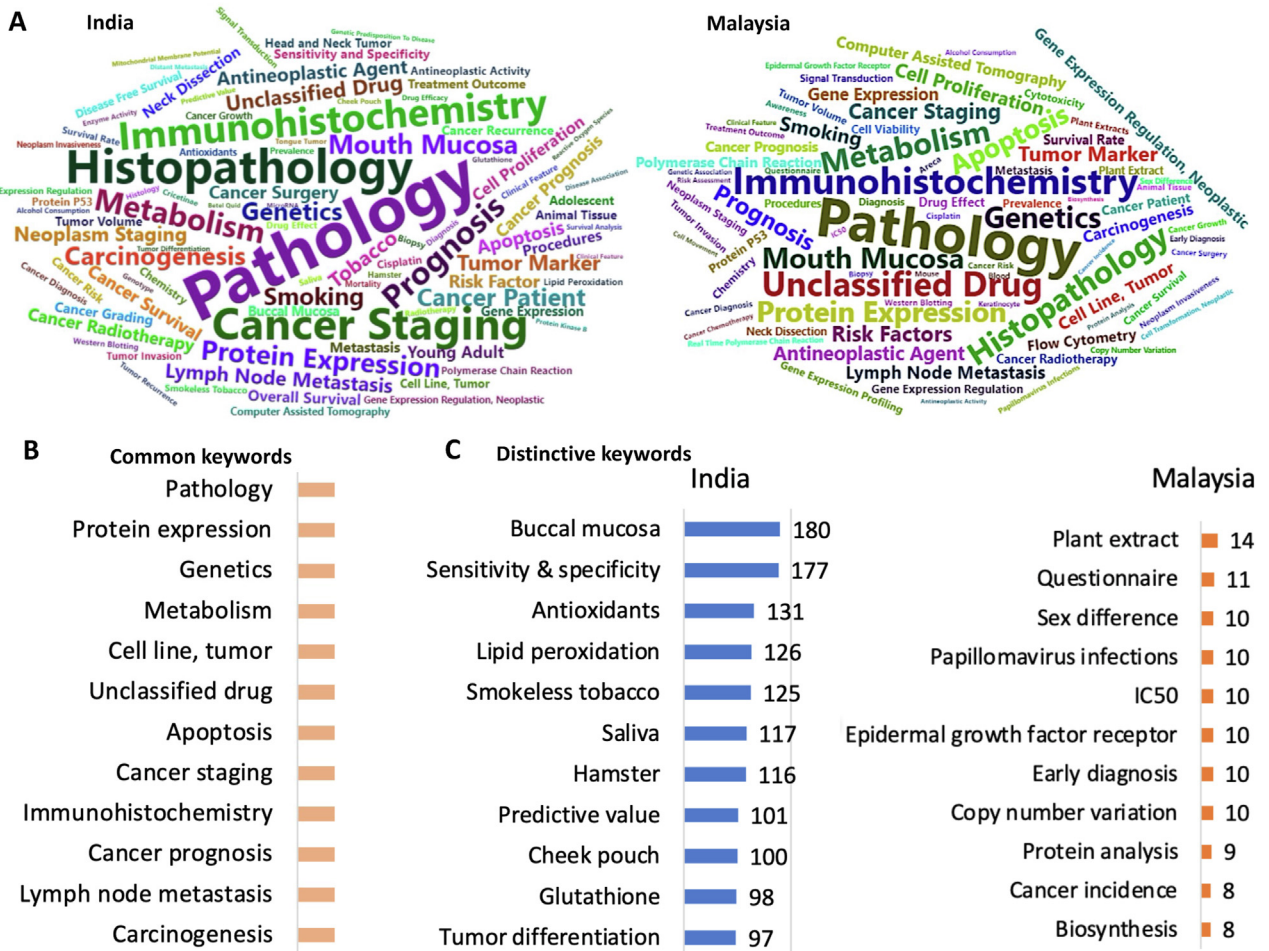


Figure 3 Research characteristics of the articles on oral cancer from India and Malaysia. (A) Cloud graphs of research keywords. The ranks of (B) common keywords and (C) distinctive keywords.

(n = 37; epidermal growth factor receptor (EGFR), copy number variation, protein analysis, and biosynthesis), followed by epidemiology (n = 29; cancer incidence, sex difference, and questionnaire) and drug research (n = 14; plant extract).

## Discussion

The status of the disease burden of oral cancer has changed across regions of the globe over the past 30 years, with a downward trend observed in high-income countries.<sup>10</sup> However, oral cancer in Asia, especially South Asia, remains a significant public health problem due to the increasing disease burden.<sup>10</sup> It has been reported that India accounted for about one-third of the total global burden of oral cancer,<sup>4,11</sup> partly because India is the most populous country with highest population density. Based on the scientific output and influence of oral cancer research, India and Malaysia are the representative countries in South Asia and Southeast Asia. This bibliometric analysis helps in evaluating the historical citation and research characteristics in the oral cancer field that has undergone scientific evolution over the past decades in South Asia (India) and Southeast Asia (Malaysia). The most of the articles from India and Malaysia were not of high impact, owing to the most of articles being low-quality evidence (controlled study, retrospective study, animal experiment, and case–control study) and not of high-quality evidence (e.g. RCT). It should be acknowledged that conducting high-quality studies is challenging because they require multi-center collaborations, a lot of personnel, large funding grants, and patients' consent.

The research keywords can reflect the directions and concerned topics of research. Tobacco smoking, alcohol consumption, and areca nut as risk factors were common keywords, attention should be paid to them while developing policies for oral cancer control.<sup>12,13</sup> Pathology, protein expression, immunohistochemistry, genetics, metabolism, apoptosis, prognosis, and lymph node metastasis were top-20 common keywords among publications. In India, the distinctive keywords buccal mucosa and smokeless tobacco reflect that chewing smokeless tobacco affects buccal mucosa. In addition to smokeless tobacco, smoking and tobacco were among the top-20 common keywords in India, compared to other regions. Tobacco smoking and smokeless tobacco are significant attributable risk factors for oral cancer in India. The keywords hamster and cheek pouch reflect 7,12-dimethylbenz(a)anthracene-induced hamster cheek pouch carcinoma as a common chemical carcinogen-induced animal model of experimental oral carcinogenesis in India. The keywords antioxidants, lipid peroxidation, and glutathione reflect some substances that may play roles in oral carcinogenesis that are frequently researched by Indian scholars.

In Malaysia, plant extract, questionnaire, HPV, EGFR, early diagnosis, and copy number variation indicate distinctive keywords that are mainly cited by Malaysian scholars. The keywords in Taiwan and mainland of China were analyzed previously.<sup>9</sup> In Chinese Taiwan, reactive oxygen, mitochondrial membrane, cell death, and protein phosphorylation as the basic research keywords are mainly

used. Single nucleotide polymorphism is a genetic predisposition to oral cancer, and mastication reflects that chewing areca nut as a risk factor for oral cancer is common in Taiwan.<sup>9</sup> In Chinese mainland, genetic transfection, long untranslated RNA, epithelial mesenchymal transition, and protein function are mainly used keywords related to basic science research. CAL-27 cell line, gene silencing, gene knockdown, colony formation, MTT assay, cell cycle, small interfering RNA, bioinformatics, luciferase assay, transwell assay, and tumor xenograft indicate these in vitro and in vivo experiment designs and methods for oral cancer research that are common in Chinese mainland.<sup>9</sup> Bibliometric characteristics including authors, institutions, and research keywords were identified in order, which would aid clinicians and researchers in promoting mutual understanding and more reciprocal cooperation regarding oral cancer research.

It's worth noting that there were gaps in oral cancer research originating from South and Southeast Asia. The vast majority of top-100 most-cited articles on oral cancer were reported to have originated from the United States and European countries,<sup>14,15</sup> partly attributed to the large size of the American and European scientific communities and the higher research budget compared with other parts of the world. The most serious burden of oral cancer caused by not only smoking and alcohol consumption but also smokeless and areca nut use remains in South and Southeast Asia.<sup>1</sup> This is closely related to surveillance centers, screening programs, public awareness, clinicians' awareness, delays in diagnosis, stage at diagnosis etc., thus trying to incentivize public health authorities, young scholars, and healthcare providers from those countries to deal with oral cancer.<sup>16–18</sup> On the other hand, many low-and middle-income countries have difficulties in implementing the WHO Framework Convention on attributable risk factors control,<sup>10</sup> leading to failure to achieve goals of scheduled risk factors control.

In summary, this study for the first time reported the scientometric/bibliometric characteristics of oral cancer research in South Asia (India) and Southeast Asia (Malaysia). It is essential to improve the public awareness of primary oral cancer prevention and develop the economy, in order to control attributable risk factors and eventually reduce the oral cancer burden, especially in low-and middle-income countries. Our findings could be also used to guide future research efforts, especially in the collaborations within the region, and outside the region with Western countries.

## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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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.2024.03.014>.

## References

- Zhu S, Zhang F, Zhao G, et al. Trends in the global burden of oral cancer joint with attributable risk factors: results from the global burden of disease study 2019. *Oral Oncol* 2022;134:106189.
- Liu H, Yu Z, Xu Z, Liu T, Liu W. A scientometric study of tobacco and alcohol use as risk factors for oral cavity health. *J Dent Sci* 2024;18:1883–8.
- Wang G, Yu Z, Ji T, Shi L, Liu W. A scientometric study of betel quid chewing and oral cancer and precancerous lesions with distinct regional characteristic. *J Dent Sci* 2023;18:1378–83.
- Sun R, Dou W, Liu W, et al. Global, regional, and national burden of oral cancer and its attributable risk factors from 1990 to 2019. *Cancer Med* 2023;12:13811–20.
- Xie L, Shang Z. Burden of oral cancer in Asia from 1990 to 2019: estimates from the global burden of disease 2019 study. *PLoS One* 2022;17:e0265950.
- Yang LC, Liu FH, Liu CM, Yu CH, Chang YC. Bibliometric analysis of top-cited articles in journal of dental sciences. *J Dent Sci* 2023;18:338–44.
- Chen MC, Chen SH, Cheng CD, et al. Mapping out the bibliometric characteristics of classic articles published in a Taiwanese academic journal in dentistry: a scopus-based analysis. *J Dent Sci* 2023;18:1493–509.
- Yang X, Yang X, Ji T, Zhou Q, Liu W. A bibliometric analysis of the papers on oral potentially malignant disorder in Oral Oncology. *Oral Oncol* 2022;132:105996.
- Xie C, Ou J, Shi H, Liu W. Oral cancer research in Taiwan and mainland China: scientometric analysis with emphasis on distinctive characteristics. *J Dent Sci* 2022;17:1859–63.
- Kharbanda OP, Ivaturi A, Priya H, Dorji G, Gupta S. Digital possibilities in the prevention and early detection of oral cancer in the WHO South-East Asia Region. *WHO South East Asia J Public Health* 2019;8:95–100.
- Subash A, Bylapudi B, Thakur S, Rao VUS. Oral cancer in India, a growing problem: is limiting the exposure to avoidable risk factors the only way to reduce the disease burden? *Oral Oncol* 2022;125:105677.
- Leuci S, Coppola N, Viglione AP, et al. Knowledge, attitude, and practice in oral cancer: a national survey on 150 dental hygienists. *Oral Dis* 2023;29:3205–13.
- Ribeiro MFA, Oliveira MCM, Leite AC, et al. Assessment of screening programs as a strategy for early detection of oral cancer: a systematic review. *Oral Oncol* 2022;130:105936.
- Pena-Cristóbal M, Diniz-Freitas M, Monteiro L, Diz Dios P, Warnakulasuriya S. The 100 most cited articles on oral cancer. *J Oral Pathol Med* 2018;47:333–44.
- Hassona Y, Qutachi T. A bibliometric analysis of the most cited articles about squamous cell carcinoma of the mouth, lips, and oropharynx. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2019;128:25–32.
- Semprini J. Oral cancer screening prevalence in low-income adults before and after the ACA. *Oral Oncol* 2022;134:106055.
- Silva LC, Faustino ISP, Ramos JC, et al. The importance of early treatment of oral squamous cell carcinoma: case report. *Oral Oncol* 2023;144:106442.
- Misra SR, Das R. Early Discovery, Early Recovery: the principle behind successful oral squamous cell carcinoma treatment. *Oral Oncol* 2023;145:106511.