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Original Article

A scientometric study on research trends and characteristics of lymphoma involving the oral cavity

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Early diagnosis;
Lymphoma;
Non-Hodgkin
lymphoma;
Oral manifestations

Abstract *Background/purpose:* Oral manifestations may present as the first and only sign of lymphoma that primarily affect the oral mucosa, gingiva, and salivary glands. The purpose of this study was to analyze the scientometric characteristics and research trends of lymphoma involving the oral cavity.

Materials and methods: All the papers on oral involvement of lymphoma were comprehensively retrieved from the Scopus database. The years of publication were divided into before 2011 and Jan 2011–Jul 2025 in the analysis of research trends.

Results: There were 557 relevant papers on lymphoma involving the oral cavity, with total citations of 7663 and the *h* index of 39. The most related type or subtype of lymphoma was non-Hodgkin lymphoma, followed by B cell lymphoma, large cell lymphoma, Burkitt lymphoma, plasmablastic lymphoma, T cell lymphoma. The most treatment keyword were cyclophosphamide, followed by doxorubicin, vincristine, prednisone, cancer chemotherapy, and cancer radiotherapy. The trend of clinical aspect has changed to retrospective study, diagnostic imaging, positron emission tomography-computed tomography (PET-CT), cervical lymph node, complication, osteolysis, and cytarabine after 2011. The trend of laboratory aspect has changed to cyclin D1, Bcl-6, syndecan-1, Ki-67, CD5, CD79a, metabolism, lactate dehydrogenase, tumor marker, and gene rearrangement.

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Conclusion: This scientometric study for the first time elucidated the current scenario and research trends in the field of lymphoma involving the oral cavity, underpinning that stomatologists and dentists can play active roles in providing early recognition and timely diagnosis of this malignancy.

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Introduction

Lymphomas are the third most common cancer worldwide and the second most frequent malignancy in the head and neck region. Oral manifestations may present as the first and only sign of lymphomas that primarily affect the oral mucosa, gingiva, salivary glands, tonsils, and retromolar region.^{1,2} The intraoral manifestations are usually asymptomatic soft swelling, ulceration, pain, and tooth mobility; and the extraoral presentations are facial asymmetry and cervical lymphadenopathy.^{1,2} These manifestations are often difficult to diagnose because they present clinical presentations that mimic other diseases such as oral mucosal diseases, periodontal diseases, and other cancers mainly squamous cell carcinoma.^{2–4} In this context, the incorrect diagnosis and treatment of lymphoma-related oral manifestations may be delayed thereby worsening the prognosis.^{5,6} As can be seen, the diagnosis can only be established through biopsy and the differential diagnosis is essential for treatment. Hence, stomatologists and dentists can play key roles for performing early diagnoses of lymphoma and referring patients to adequate treatment.

Despite advances in medical approaches and the advent of gene-targeted therapy for lymphoma, most patients still receive their diagnosis at an advanced stage of the disease due to the elusive nature of this malignancy.¹ Compared with gastrointestinal tract and other organs, lymphoma is easy to be detected in the oral cavity and head and neck region. Stomatologists can play roles in providing early recognition and timely diagnosis of lymphoma when it involved the oral cavity and maxillofacial region. Scientometrics is a useful tool that utilizes citation and bibliometric data to measure scientific output and research trend of a specific research field.^{7–9} The bibliometric analyses on in some fields of lymphoma have been reported previously,^{10–12} but there is lack of an analysis on oral involvement of lymphoma. Hence, the purpose of this study was to analyze the scientometric characteristics and research trends of all the papers on lymphoma involving the oral cavity, in order to highlight the awareness of early recognition and timely diagnosis and improve the access to care for this malignancy.

Materials and methods

As per the methodology described previously,^{7–9} all the papers on lymphoma involving the oral cavity in the Scopus database were retrieved on 01 Aug 2025. In literature search, we used medical subject terms “lymphoma” in the Title and “oral cavity OR oral mucosa OR oral health OR oral

lesion OR oral manifestation OR oral sarcoma OR dent* OR intraoral OR mouth OR tongue OR buccal OR cheek OR lip OR labial OR gingiv* OR palat*” in all fields of the papers. There was not restriction to paper type and year of publication, while language was restricted to the English as an international knowledge-exchange language. The scientometric characteristics of all the eligible papers were 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. The years of publication were divided into before 2011 and Jan 2011–Jul 2025, so that the number of papers can be to some extent compared in the analysis of research trends. Microsoft Office Excel 365 was used for index model building, and the Bibliometrix Biblioshiny R-package software was used for bibliometric statistics. In this descriptive study, variables were presented as numbers and percentages. No comparisons were made, and thus no *P*-values were set.

Results

Citation characteristics

With the search strategy algorithm, a total of 557 papers on lymphoma involving the oral cavity were retrieved in the Scopus database. As presented in Fig. 1A, the most type of papers on lymphoma was case report ($n = 341$), followed by clinical article ($n = 94$) and review ($n = 28$). The total citation count (after removal of self-citations) was 7663 (7289) and the *h* index was 39 (39) for all the papers. To further concretize the trends of scientific output, we assessed the annual number and accumulated citations of the papers during 2005–2024 (Fig. 1B). The annual number of the papers on lymphoma involving the oral cavity changed between 12 and 32 during 2005–2024. The accumulated citations (after removal of self-citations) of the papers changed between 136 (125) to 445 (432) during this period. The detailed information on publication year, authors, title, abstract, journal of publication, citation count, institutions, and keywords of the 100 most-cited papers are presented in Supplementary Table S1.

Bibliometric characteristics

Fig. 1C displays cloud graphs of journals of publications, contributing authors, institutions, and countries/regions of origin of the papers on lymphoma involving the oral cavity,

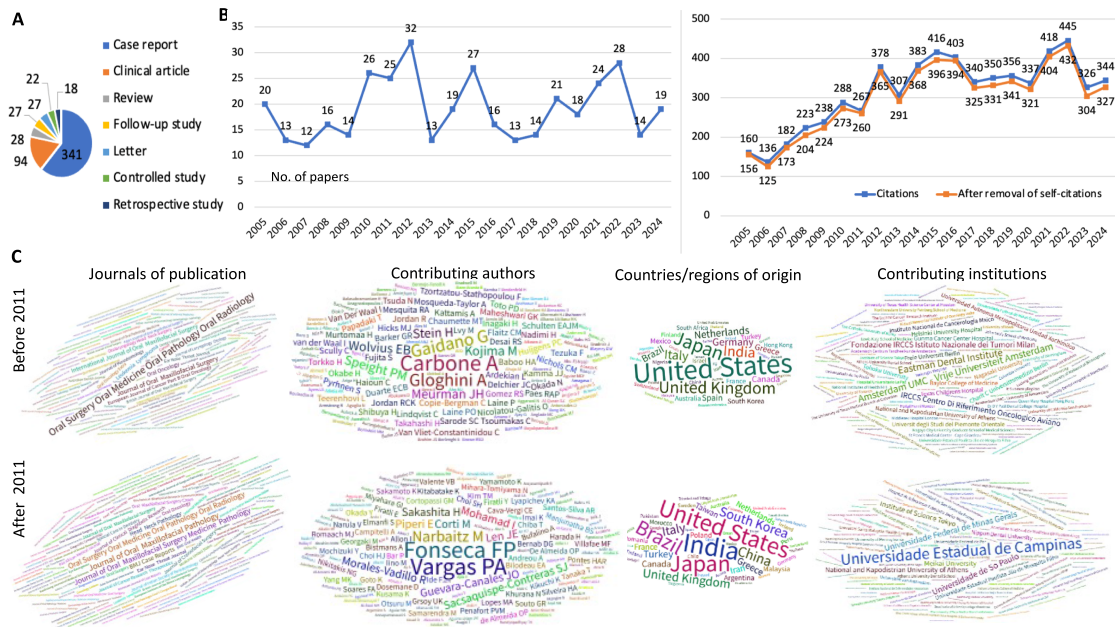


Figure 1 Bibliometric characteristics of the papers on lymphoma involving the oral cavity. (A) The numbers of different paper types. (B) The annual number and accumulated citations of the papers during 2005–2024. (C) Cloud graphs of journal of publication, contributing authors, countries/regions and institutions of origin regarding lymphoma publications before 2011 and after 2011. The font size indicates the number of papers; a larger size means more papers in the cloud graphs.

which were divided into before 2011 (296 papers) and Jan 2011–Jul 2025 (261 papers), so that the number of papers can be to some extent compared in the analysis. Before 2011, the journal of publication, contributing author, institution and country of origin with largest number of papers was *Oral Surgery Oral Medicine Oral Pathology Oral Radiology* (n = 26), Carbone, A. (n = 5), Amsterdam UMC - Vrije Universiteit Amsterdam and Eastman Dental Institute (both n = 5) and United States (n = 64), respectively. After 2011, the journal of publication, contributing author, institution and country of origin with maximum number was *Journal of Oral & Maxillofacial Pathology* (n = 14), Fonseca, F.P and Vargas, P.A. (both n = 6), Universidade Estadual de Campinas (n = 11) and India (n = 51), respectively.

Research characteristics

Based on the frequency of the keywords in all the papers on lymphoma involving the oral cavity (Fig. 2A), the lymphoma-related diseases, treatment keywords, and research keywords were identified. The most related disease of oral involvement of lymphoma was non-Hodgkin lymphoma, followed by B cell lymphoma, large cell lymphoma, Burkitt lymphoma, plasmablastic lymphoma, T cell lymphoma, diffuse large B-cell Lymphoma, Epstein–Barr virus, and so on (Fig. 2B). The most treatment keyword were cyclophosphamide, followed by doxorubicin, vincristine, prednisone, cancer chemotherapy, cancer radiotherapy, and so on (Fig. 2C). Before 2011 and Jan 2011–Jul 2025, there have always been the same common keywords such as pathology, immunohistochemistry, histopathology,

computer assisted tomography, nuclear magnetic resonance imaging, antineoplastic agent, differential diagnosis, CD20 Antigen, CD3 antigen, CD45 antigen, protein Bcl-2, prognosis, and in situ hybridization.

Based on the keywords of papers on lymphoma involving the oral cavity published in different years (Fig. 2D), the more common keywords can basically reflect research trends. Before 2011, cancer diagnosis, cancer localization, cancer survival, fatality, fatal outcome, preschool child, AIDS-related lymphoma, CD4 antigen, genetics, human herpesvirus (HHV)-8, immunoglobulin heavy chain, laboratory test were more frequent keywords regarding clinical and laboratory aspects. Gingival neoplasms, jaw tumor, maxillary neoplasms, mouth ulcer, paranasal sinus neoplasms, and salivary gland neoplasms were more frequent keywords regarding lymphoma involving the oral cavity. Bleomycin, combined modality therapy, dacarbazine, dexamethasone, vincristine sulfate, and highly active antiretroviral therapy were more common keywords of drug research.

After 2011, anaplastic large cell lymphoma, lymphadenopathy, follicular lymphoma, school child, young adult, retrospective study, diagnostic imaging, positron emission tomography-computed tomography (PET-CT), fluorodeoxyglucose F18, mandible, cheek, mouth examination, cervical lymph node, complication, swelling, disease duration, dysphagia, osteolysis, and cytarabine were more common keywords regarding clinical aspect. Cyclin D1, protein Bcl-6, syndecan-1, Ki-67 antigen, CD5 antigen, CD79a antigen, common acute lymphoblastic leukemia antigen, metabolism, protein expression, tumor marker, HHV-4, virus load, immunoglobulin kappa chain, lymphocytic infiltration, lactate dehydrogenase, gene rearrangement, and cell

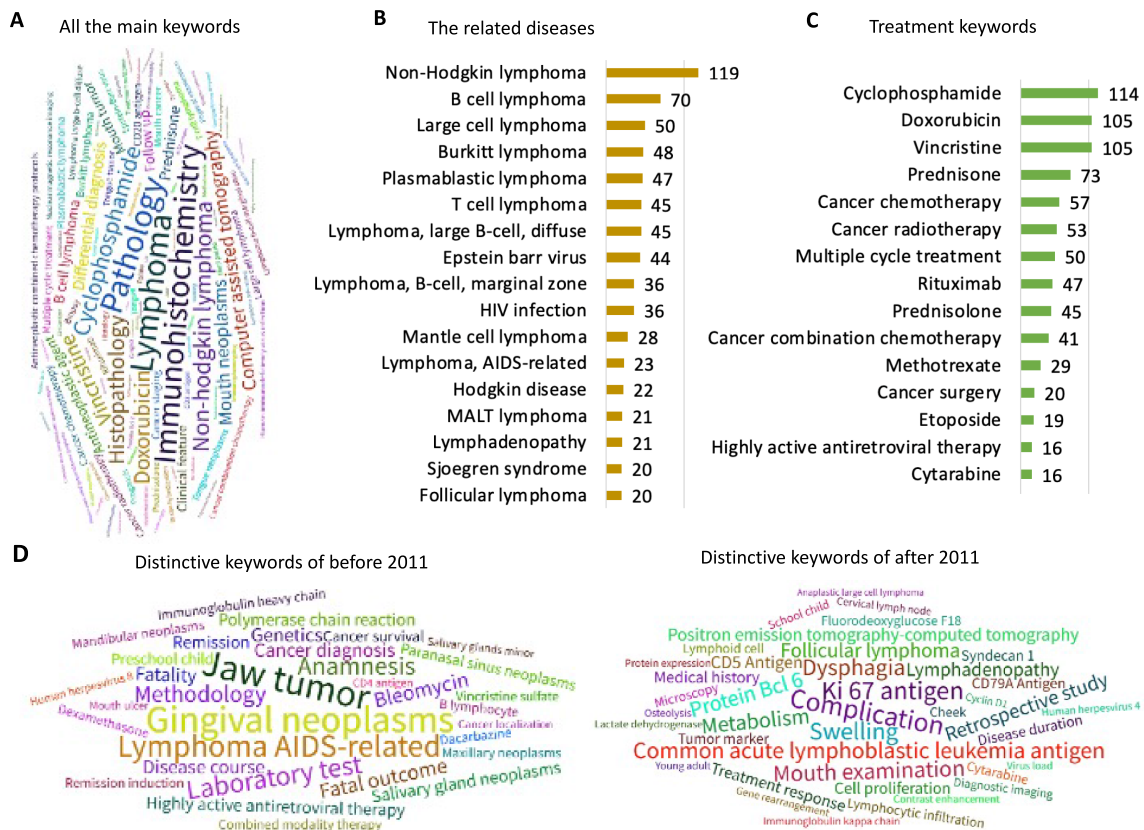


Figure 2 Research characteristics of the papers on lymphoma involving the oral cavity. (A) Cloud graph of all the main keywords. (B) The related diseases. (C) The treatment keywords. (D) Cloud graphs of distinctive keywords of papers published before 2011 and after 2011. The font size indicates the number of papers; a larger size means more papers in the cloud graphs.

proliferation, were more frequent keywords regarding laboratory aspect.

Discussion

This scientometric study attempted to analyze the bibliometric characteristics and research trends of all the papers on lymphoma involving the oral cavity. Bibliometric characteristics including journals of publications, contributing authors, institutions and countries of origin, and keywords in sequence would aid clinicians and researchers in choosing target journals, finding potential collaborators or partner institutions, as well as promoting mutual understanding and more reciprocal cooperation regarding lymphoma research. Importantly, keywords frequency can reflect the hotspots and concerned topics of research. As shown in Fig. 2B, oral involvement was reported to be associated with various types of lymphoma, which is mainly divided into Hodgkin's lymphoma and non-Hodgkin's lymphoma (NHL). NHL is diagnosed in extranodal sites in 40 % of all lymphomas, and the most frequent lymphoma in the oral cavity and maxillofacial region is NHL.¹ Further, morphological, immunophenotypic, and cytogenetic features are essential for the classification of each subtype of NHL, such as B cell lymphoma, T cell lymphoma, Burkitt lymphoma, AIDS-related lymphoma.^{13–20}

The strength of this scientometric study was to perform the chronological comparison (before 2011 versus after

2011) based on all the included papers. The more common keywords in different years can basically reflect research trends (Fig. 2D). Currently, the treatment for lymphoma mainly depends on systematic chemotherapy with or without radiotherapy. If lymphomas respond very well to chemotherapy, oral manifestations start regressing from the seventh day of treatment. Due to tumor heterogeneity, toxic side effects and the emergence of drug resistance in systemic chemotherapy, patient outcomes are compromised, influencing both prognosis and quality of life. Herein, we highlight the awareness of early recognition and timely diagnosis and improve the access to care for lymphoma, since oral involvement constantly constitutes the first sign of this malignancy. Conversely, misdiagnosing and applying the wrong treatment, such as dental procedures, may end up delaying the correct diagnosis and worsening the prognosis. Once the diagnosis of oral lymphoma is identified by histopathologic biopsy, it is mandatory to accurately classify the subtype of lymphoma, which is fundamental to therapy and prognosis assessment.

In summary, this study for the first time elucidated the scientometric characteristics and research trends in the field of lymphoma involving the oral cavity, underpinning that stomatologists and dentists can play active roles in providing early recognition and timely diagnosis of this malignancy. A good medical history, detailed clinical and imaging evaluations, and attention to the patient's signs and symptoms are critical for the correct diagnosis and

appropriate treatment, which in turn can lead to better patient prognosis.

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.2025.09.009>.

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