

Bibliometric Analysis of Sialography Research

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Abstract

This study was conducted to evaluate the thematic and conceptual structure of scientific production in the field of sialography using bibliometric analysis methods. Publications indexed in the Web of Science Core Collection database between 1995 and 2025 were analyzed using R, RStudio, Biblioshiny, and the bibliometrix package. Annual Scientific Production Analysis, Authors' Keywords Co-occurrence Network Analysis, Trend Topics Analysis, Thematic Map Analysis, and Thematic Evolution Analysis were performed. The analyses demonstrated an increasing trend in scientific production over the years, with "sialendoscopy," "sialadenitis," and "submandibular gland" emerging as prominent topics in recent years. In addition, "magnetic resonance imaging" and "sjogren's syndrome" themes became more prominent after 2011. Overall, the findings indicate that research in the field of sialography has evolved over time and that academic interest in the combined use of sialography with advanced imaging modalities has increased.

Keywords: Bibliometric Analysis, Salivary Glands, Sialography

1. Introduction

Sialography is a radiographic technique that aims to visualize the structure of the salivary gland duct system in detail by administering contrast material into the salivary gland ducts. After the administration of contrast material, its distribution is evaluated using different imaging modalities [1, 2]. In this technique, the ductal orifice of the salivary gland is initially dilated using an instrument such as a periodontal probe. Subsequently, contrast material is injected into the duct through a cannula. After allowing sufficient time for the distribution of the contrast agent, imaging is performed using both two-dimensional techniques, such as occlusal radiography, and three-dimensional modalities, such as cone beam computed tomography. This method can demonstrate obstructions within the salivary gland ducts and may also have a therapeutic effect through lavage in cases where ductal calculi are very small. Although this technique provides detailed visualization of the salivary gland ductal system, its disadvantages include being an invasive procedure, the possibility of adverse reactions to contrast agents, and contraindication in patients with acute salivary gland infections [3-7].

Numerous studies have been conducted on sialography, and these studies have generally focused on the diagnosis of different pathologies and the combined use of sialography with various imaging modalities [8-12]. This field of research is rapidly evolving, making it increasingly difficult to examine the conceptual structure and evolution of the literature related to this topic. Considering the limited information in the literature regarding conceptual structure analysis, thematic analysis, and performance analysis in the field of sialography, there is a need to investigate the thematic evolution and development of scientific content in this area. Bibliometric analysis is a method capable of addressing this need. By

applying bibliometric methods such as Annual Scientific Production Analysis, Keyword Co-occurrence Network Analysis, Trend Topics Analysis, Thematic Map Analysis, and Thematic Evolution Analysis, the current status, evolution, and scientific production of sialography research can be quantitatively evaluated [13-16].

The aim of this study was to evaluate the scientific production, thematic structure, and conceptual framework of the current literature on sialography using bibliometric analysis methods, including Annual Scientific Production Analysis, Keyword Co-occurrence Network Analysis, Trend Topics Analysis, Thematic Map Analysis, and Thematic Evolution Analysis.

2. Materials and Methods

This study was designed as a bibliometric analysis related to sialography. Since no human or animal subjects were involved due to the nature of the bibliometric analysis method, ethical committee approval was not required for this study.

In the present study, the dataset was obtained by searching the advanced search section of the Web of Science Core Collection (WoSCC) database using the query ((sialography OR sialograph* OR “salivary gland imaging”) AND (dental OR oral OR maxillofacial OR radiology OR imaging)). To increase the reliability of the dataset, editorial letters, conference proceedings, case reports, and publications unrelated to sialography were excluded, and only articles published between 1995 and 2025 were included in the analysis.

The bibliometric analyses were performed using R (version 4.6.0), RStudio, and Biblioshiny through the bibliometrix package (version 5.3.0). Within the scope of performance analysis, Annual Scientific Production Analysis was conducted, while Authors’ Keywords Co-occurrence Network Analysis, Trend Topics Analysis, Thematic Map Analysis, and Thematic Evolution Analysis were applied as part of the science mapping analysis.

The conceptual structure of the literature related to the subject was analyzed using network-based clustering approaches. In the network-based clustering structure, colors represented different thematic clusters, node sizes indicated keyword frequency, and edge thickness reflected co-occurrence strength. The thematic map analysis was evaluated under the categories of basic themes, motor themes, niche themes, and emerging/declining themes.

3. Results

Within the scope of this study, 405 articles indexed in the WoSCC database were evaluated. The Annual Scientific Production Analysis demonstrated fluctuations in the number of annual scientific publications between 1995 and 2025. The highest scientific production was observed in 2018, whereas the lowest publication output was identified in 1995 and 2003. A decline in annual scientific production was observed between 2018 and 2022, followed by an increasing trend after 2022 (Figure 1).

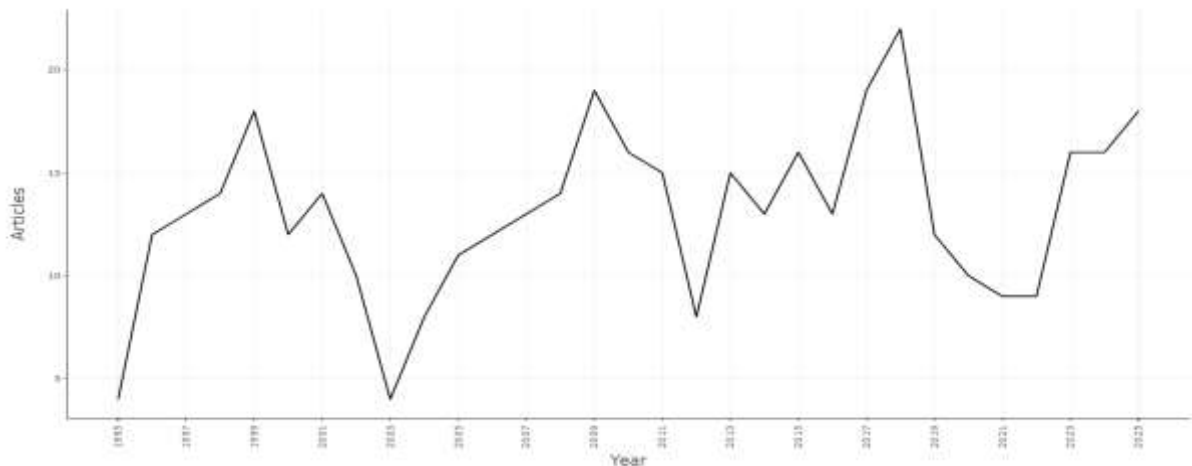


Figure 1. Annual Scientific Production Related to Sialography Between 1995 and 2025.

The Keyword Co-occurrence Network Analysis revealed that the terms “sialography” and “salivary glands” were located at the center of the network structure and exhibited strong connection density. Strong associations were identified between the term “sialography” and the terms “parotid gland,” “sjogren’s syndrome,” and “ultrasonography.” In addition, the terms “magnetic resonance imaging,” “computed tomography,” “xerostomia,” “sialolithiasis,” and “sialendoscopy” formed nodes in different regions of the network structure (Figure 2).

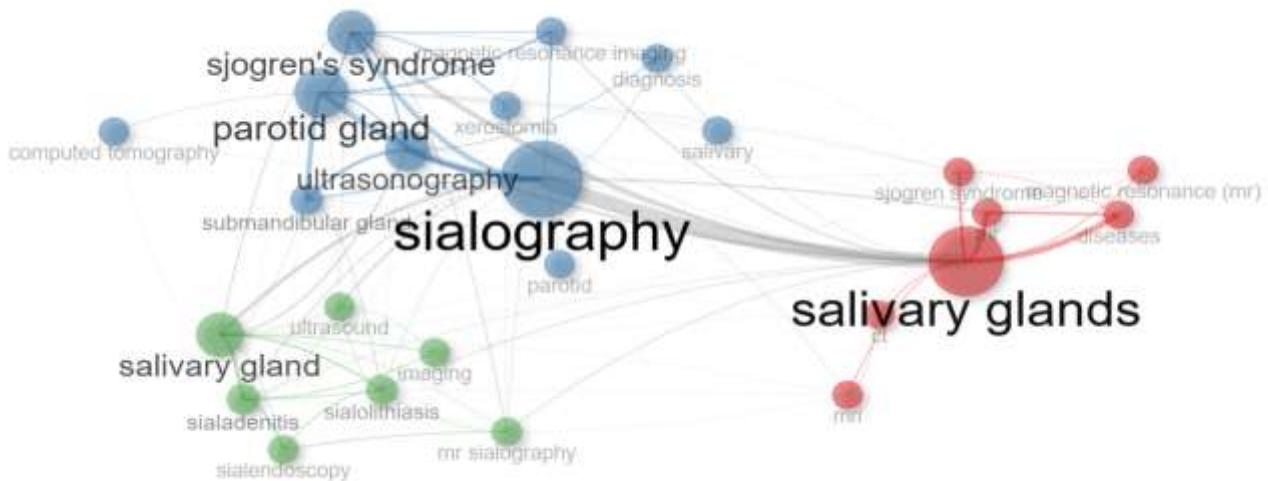


Figure 2. Authors’ Keywords Co-occurrence Network Related to Sialography.

The Trend Topics Analysis demonstrated that the terms “mr” and “xerostomia” were prominent during the early period, whereas “parotid gland” and “magnetic resonance imaging” became more prominent during the middle period. In recent years, the terms “ultrasonography,” “sialadenitis,” “sialendoscopy,” and “submandibular gland” have gained prominence. In addition, the terms “sjogren’s syndrome” and “mr sialography” were found to maintain their presence across different time periods in the literature (Figure 3).

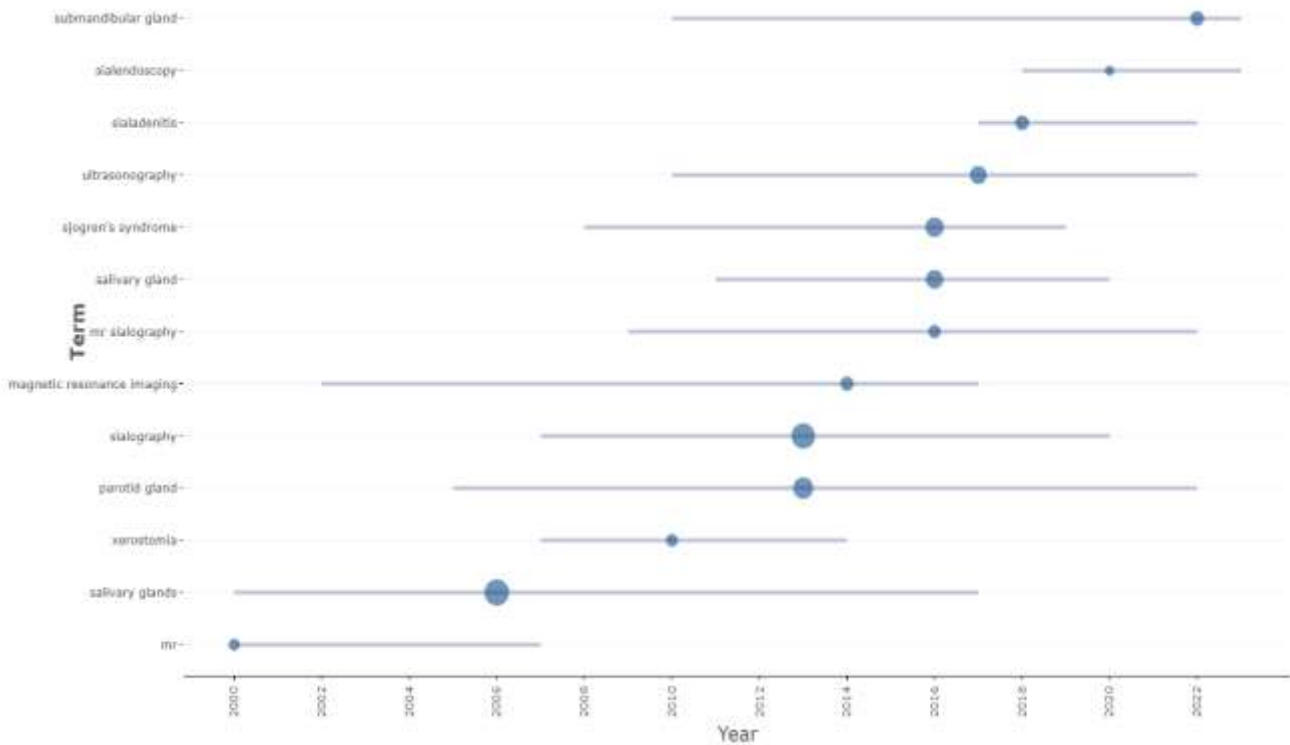


Figure 3. Trend Topics Analysis of Keywords Related to Sialography Research.

The Thematic Map Analysis revealed that the terms “salivary glands,” “parotid-gland,” and “gland” were located within the cluster of basic themes with high centrality values. In addition, the terms “mr sialography,” “sialolithiasis,” and “management” were also included in the basic themes cluster. The terms “salivary-glands,” “parotid gland,” and “xerostomia” were identified within the motor themes cluster, whereas “tissue,” “accessory parotid-gland,” “cyst,” “removal,” “salivary gland diseases,” and “salivary ducts” were located within the niche themes cluster. Furthermore, the terms “sialography,” “diagnosis,” and “ultrasonography” were found to be positioned in the central transition regions of the thematic map (Figure 4).

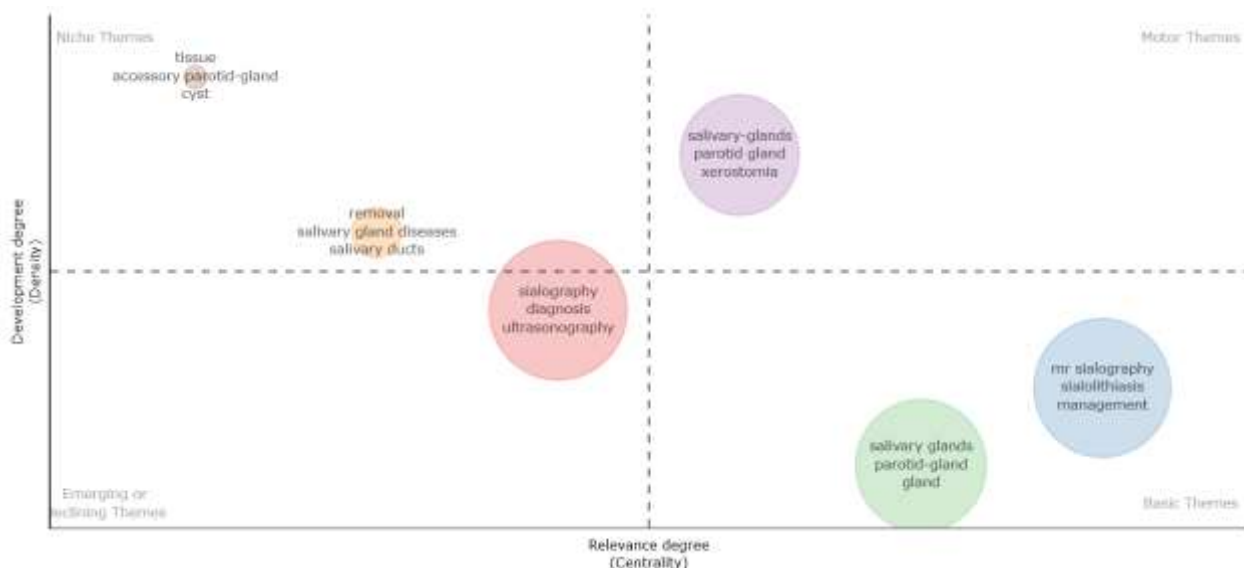


Figure 4. Thematic Map Analysis of Sialography-Related Research Topics.

The Thematic Evolution Analysis demonstrated that although thematic continuity was generally observed between the periods before and after 2011, the themes “magnetic resonance imaging” and “sjogren’s syndrome” became more prominent in the post-2011 period (Figure 5).

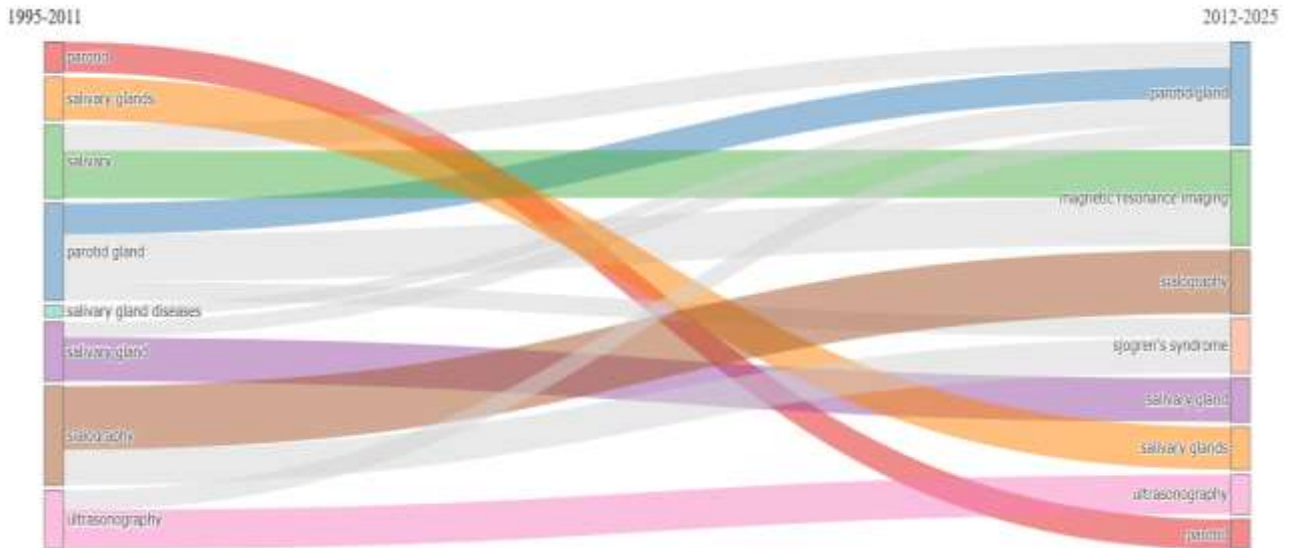


Figure 5. Thematic Evolution Analysis of Sialography-Related Research Topics Between 1995–2025.

4. Discussion

Conventional sialography, first used by Carpy in 1904, has been accepted as the gold standard for evaluating the ductal system of the salivary glands. With the advancement of technology, sialographic analysis has also been integrated with three-dimensional imaging modalities [12, 17]. This method, which is frequently used for the submandibular and parotid glands, is an invasive technique and is effective in detecting various abnormalities affecting the salivary gland ductal system, including Sjögren syndrome, chronic sialadenitis, salivary gland tumors, salivary gland stones, and ductal obstructions [12, 18-20].

There are numerous studies in the literature related to sialography [7, 12]. However, there is limited information in the literature regarding the evaluation of the conceptual structure, scientific production, and thematic evolution of this research field. Therefore, bibliometric analysis methods are needed to examine the scientific production, thematic evolution, and conceptual structure related to this topic, to evaluate the current state of the literature, and to predict the future evolution of the field [14, 15].

The Annual Scientific Production Analysis related to sialography demonstrated fluctuations in scientific production over the years; however, considering the peak and lowest points, an overall increasing trend was observed. This increase may be associated with the more widespread use of various three-dimensional imaging modalities and the growing interest in the diagnosis of salivary gland diseases in the literature [6, 21, 22].

The Authors’ Keywords Co-occurrence Network Analysis demonstrated that the terms “sialography” and “salivary glands” were centrally positioned within the network structure. The presence of the terms “ultrasonography,” “MR sialography,” “Sjogren’s syndrome,” “magnetic resonance imaging,” “computed tomography,” “xerostomia,” “sialolithiasis,” and “sialendoscopy” within the network was particularly noteworthy. These findings indicate that the use of sialography in conditions such as

Sjogren's syndrome and sialolithiasis represents a prominent research area. Furthermore, the strong associations between sialography and advanced imaging modalities suggest the presence of considerable academic interest in the combined use of sialography with these advanced imaging techniques in the literature [23-27].

The Trend Topics Analysis demonstrated that although research trends have partially changed over time, the terms "Sjögren's syndrome" and "MR sialography" maintained their presence across different time periods. This finding indicates the continuity of these topics within the field [28, 29]. The prominence of the term "xerostomia" during the early period suggests that symptom-based evaluation was initially emphasized, whereas the emergence of the terms "ultrasonography," "sialadenitis," and "sialendoscopy" in recent years indicates that research themes related to different diseases and imaging modalities have gained increasing importance [30-33].

The Thematic Map Analysis related to sialography demonstrated that the terms "salivary glands," "parotid-gland," "gland," "mr sialography," and "sialolithiasis" were located within the basic themes cluster, indicating that these topics occupy a central position within the field. This finding suggests that sialography is a highly useful imaging modality in salivary gland pathologies and is frequently used for the evaluation of the parotid gland and the diagnosis of sialolithiasis. In addition, the combined use of magnetic resonance imaging with sialography may also represent a central area of research interest [34]. The presence of the terms "accessory parotid-gland" and "cyst" within the niche themes cluster indicates that these topics represent limited and highly specific areas of research [35-37]. The location of the term "ultrasonography" within a transitional region close to the central position of the thematic map indicates that it represents an important bridging theme within the literature.

The Thematic Evolution Analysis demonstrated that the terms "parotid gland," "salivary glands," "sialography," and "ultrasonography" were observed in both periods, which may indicate that these terms have maintained their importance within the literature over time. The increased prominence of the terms "magnetic resonance imaging" and "sjogren's syndrome" after 2011 may be associated with the growing use of magnetic resonance imaging in dentistry and the increasing recent interest in autoimmune salivary gland diseases [38, 39].

The limitations of this study include the inability to evaluate the methodological quality and clinical effectiveness of the studies included in the dataset due to the nature of bibliometric analysis, the use of only English search terms, and the inclusion of publications solely from the WoSCC database. However, the high indexing standards of the WoSCC database and the fact that English is the most widely used language in the literature increase the reliability of the study.

5. Conclusion

In conclusion, scientific production related to sialography has shown an increasing trend over time, and research themes have shifted toward more specific areas such as Sjogren's syndrome. Academic interest in the combined use of sialography with three-dimensional imaging modalities and research themes related to different imaging techniques has also increased. Future studies are recommended to be designed using different databases and search terms in multiple languages.

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