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Research Article

Global Research Trends on the Mandibular Incisive Canal and Mental Foramen Anterior Loop: A Bibliometric Analysis

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Abstract

In this study, a bibliometric analysis of the dental literature related to the mandibular incisive canal and the anterior loop of the mental foramen was conducted. The aim of the study was to evaluate publication trends, the most influential authors, countries, journals, keyword networks, and research themes in this field. Data were obtained from the Web of Science Core Collection (WoSCC) database, and a total of 184 articles published between 1995 and 2025 were analyzed. Bibliometric analyses were performed using the bibliometrix package through R, RStudio, and Biblioshiny. The findings revealed a significant increase in the number of scientific publications, particularly after 2011, with the highest number of publications recorded in 2018. Jacobs Reinhilde was identified as the most productive author, while Brazil was found to have the highest scientific output. Keyword co-occurrence analysis demonstrated that the terms "mental foramen," "anterior loop," "mandibular incisive canal," and "cone beam computed tomography" were the most prominent concepts in the literature. Thematic map and thematic evolution analyses showed that early studies mainly focused on anatomical structures and implants, whereas cone beam computed tomography and radiological evaluation became the dominant themes in later years. In conclusion, this field was identified as an important and continuously developing area of research.

Keywords: Anterior Loop; Bibliometric Analysis; Cone-Beam Computed Tomography; Mandibular Incisive Canal; Mental Foramen

Abbreviations

WoSCC: Web of Science Core Collection

Introduction

The area located between the mental foramina in the mandible is considered a relatively safe region for procedures such as post-traumatic mini-screw applications, genioplasty during orthognathic surgery, and endosseous implant placement [1-3]. However, similar to all anatomical structures in the body, certain anatomical variations may also be present in the region between the mental foramina in the mandible [4,5]. The main anatomical structures in this region that may be affected during surgical procedures and potentially lead to various complications are the anterior loop of the mental foramen and the mandibular incisive canal [6].

The mandibular nerve divides into mental and incisive branches at the mental foramen. After separating from the mental foramen, the mandibular incisive canal continues as a branch of the mandibular canal and provides innervation to the incisor, premolar, and canine teeth [2,7]. The mental nerve provides sensory innervation to the soft tissues of the anterior mandibular region and, in some cases, forms a curvature known as the anterior loop while exiting from the mandibular bone toward the soft tissue [8,9]. In some cases,

surgical procedures performed in the interforaminal region may result in complications [10]. Therefore, numerous studies on this subject have been conducted by oral radiologists and surgeons [11,12]. In particular, studies in this field have increased with the growing use of endosseous implants in dentistry [11,12]. Additionally, advancements in imaging techniques have facilitated the detection of such anatomical variations [13]. Studies conducted in this field have generally focused on the prevalence and morphometric characteristics of these anatomical structures, as well as their distribution across different populations [14-16]. Despite the widespread interest in this field, studies in the literature investigating publication trends over the years, the most productive countries, journals, and authors, citation analysis, keyword co-occurrence analysis, thematic mapping, and thematic evolution analysis remain quite limited. Bibliometric analysis provides a quantitative approach to address this gap and enables comprehensive analysis of these data [17,18].

The aim of this study was to perform a bibliometric analysis of published research related to the mandibular incisive canal and the anterior loop of the mental foramen in order to evaluate publication trends, the most influential authors, countries, keyword networks, and research themes in the literature. In addition, this study aimed to reveal the scientific development process of this field and provide guidance for future research.

Materials and Methods

The present study was designed as a bibliometric analysis based on research related to the mandibular incisive canal and the anterior loop of the mental foramen, particularly in the fields of radiology and surgery within dentistry. The aim of this study was to investigate the impact, thematic structure, and evolution of research concerning the mandibular incisive canal and the anterior loop of the mental foramen. Due to the nature of bibliometric analysis methods, no human or animal subjects were involved in this study; therefore, ethical committee approval was not required.

To obtain data related to the subject, publications indexed between 1995 and 2025 in the Web of Science Core Collection (WoSCC) database were analyzed using the advanced search query ((“anterior loop” OR “incisive canal”) AND (mandible OR mandibular)). In addition, only articles were included in the analysis, while editorial letters, conference proceedings, studies unrelated to the mandibular incisive canal, and publications unrelated to the anterior loop of the mental nerve were excluded in order to obtain a more homogeneous dataset.

Bibliometric analyses were performed using the bibliometrix package (version 5.3.0) through R (version 4.6.0), RStudio, and Biblioshiny. Descriptive indicators included publication trends over years, most productive authors, journals, countries, and citation analyses.

Network-based clustering approaches were used to examine the conceptual structure of the literature. Keyword co-occurrence analysis based on author keywords was performed to investigate the conceptual organization of the literature. Furthermore, a network-based clustering algorithm was used to identify the dominant themes related to the subject. In the generated network, edge thickness represented co-occurrence strength, colors represented different thematic clusters, and node size represented keyword frequency. Thematic map analysis identified motor themes, basic themes, emerging themes, and niche themes. In addition, thematic evolution analysis was performed to evaluate changes in research themes over time.

Results and Discussion

As a result of the exclusion criteria, a total of 184 articles indexed in the WoSCC database between 1995 and 2025 were identified. Analysis of Annual Scientific Production revealed a marked increase after 2011. A significant rise in the number of publications was observed after 2011, with the highest number of publications recorded in 2018 (Figure 1).

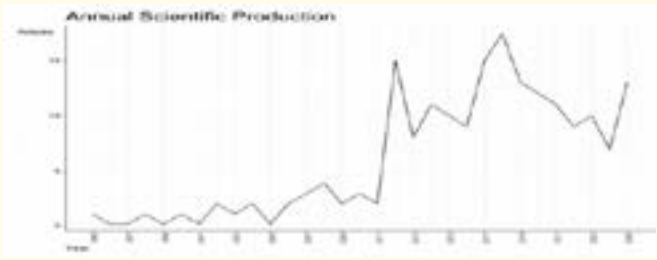

Figure 1: Number of publications related to the mandibular incisive canal and the anterior loop of the mental foramen by years (1995–2025).

In the bibliometric analysis, examination of the Most Relevant Authors revealed that Jacobs Reinhilde had the highest scientific publication output. In the Corresponding Author's Countries analysis, Brazil was identified as the country with the highest scientific production, followed respectively by India and Türkiye (Figure 2).

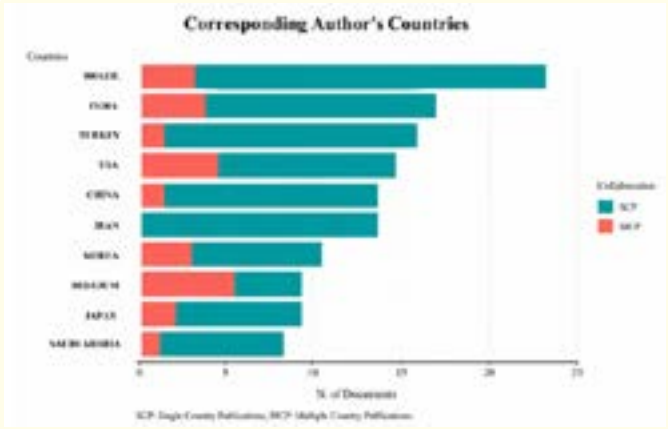

Figure 2: Analysis of Corresponding Author's Countries.

Bibliometric analysis of the most cited publications revealed that the study published by Christopher., *et al*. [19] in 2018 was the most influential publication in the literature, with 301 citations. This was followed by the study published by Jacobs e., *et al*. [20] in 2002 (Figure 3).

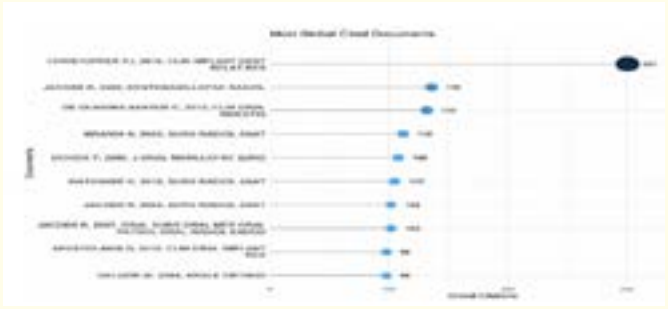

Figure 3: Analysis of the Most Cited Publications.

Examination of the most relevant and highly cited journals in this field revealed that Surgical and Radiologic Anatomy was the most cited journal, followed respectively by Clinical Oral Implants Research and Journal of Oral and Maxillofacial Surgery. Keyword co-occurrence analysis showed that the terms "mental foramen," "anterior loop," "mandibular incisive canal," and "cone beam computed tomography" were among the most frequently used concepts in the literature. Network analysis demonstrated strong relationships particularly between the keywords "mental foramen," "anterior loop," and "mandibular incisive canal." Furthermore, the analysis identified different thematic clusters associated with anatomical variations, imaging techniques, implant surgery, and complications (Figure 4).

Figure 4: Co-occurrence network analysis of author keywords used in studies related to the mandibular incisive canal and the anterior loop of the mental foramen.

Thematic map analysis revealed that the keywords "mental foramen," "anterior loop," and "inferior alveolar nerve" were classified within the basic themes, whereas themes related to "mental nerve," "appearance," and "CT" were identified among the motor themes. In addition, the keywords "tomography," "bone," and "morbidity" were grouped under niche themes, while themes associated with "alveolar nerve," "patterns," and "imaging" were classified as emerging or declining themes (Figure 5).

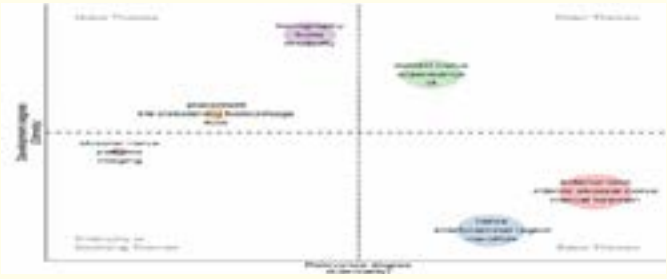

Figure 5: Thematic map analysis of studies related to the mandibular incisive canal and the anterior loop of the mental foramen.

Thematic evolution analysis demonstrated that the themes "incisive canal," "cone beam computed tomography," "mandibular nerve," "mental nerve," and "implants" were prominent between 1995 and 2012. During the 2013–2025 period, research trends were observed to concentrate particularly around the themes "cone beam computed tomography," "mandibular canal," and "mental foramen." Furthermore, it was determined that early studies focused on implants and the mental nerve evolved over time toward themes related to imaging techniques and anatomical evaluations (Figure 6).

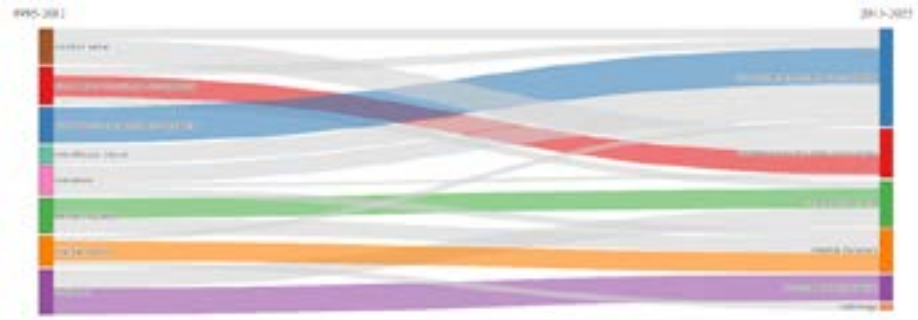

Figure 6: Thematic evolution analysis of studies related to the mandibular incisive canal and the anterior loop of the mental foramen.

In this study, the bibliometric structure of publications related to the mandibular incisive canal and the anterior loop of the mental foramen in the field of dentistry was investigated. Publication trends over the years, the most relevant authors and their countries, the most influential publications, the most cited journals, keyword co-occurrence analysis, thematic map analysis, and thematic evolution analysis were evaluated.

According to the data obtained in our study, a marked increase in scientific publications has been observed after 2011. This increase may be attributed to the exponential rise in the use of cone beam computed tomography in dentistry and the growing prevalence of dental implant applications in the field of dentistry [21,22]. This situation may be attributed to the increased interest of researchers due to the association of these anatomical structures with surgical complications [12,23]. In the citation analysis of our study, the publication by Christopher., *et al*. [19] was identified as the most influential study. In that study, it was reported that the anterior loop of the mental foramen could be detected more successfully using cone beam computed tomography compared with panoramic radiography, and consequently, complications during surgical procedures in the related region could potentially be prevented. Additionally, in the study conducted by Jacobs., *et al*. [20] morphometric analysis of the incisive canal was performed using three-dimensional imaging methods. In this context, the most highly cited publications support the view that the increasing use of cone beam computed tomography technology and intraosseous implants has contributed to the growing interest in this field.

When the countries contributing most to the literature on the mandibular incisive canal and the anterior loop of the mental foramen were examined, Brazil was found to rank first, followed by India and Türkiye. Brazil, India, and Türkiye are classified among developing countries [24]. This finding suggests that academic interest in this subject has increased in developing countries. It is also thought that the growing use of CBCT may have contributed to this trend and that the evaluation of anatomical variations using this imaging modality may have become a popular research topic. In the keyword co-occurrence analysis, the keywords "mandibular incisive canal," "mental foramen," "anterior loop," and "cone beam computed tomography" were identified as the most prominent terms. Evaluation of these keywords indicates that the literature mainly focuses on the radiological assessment of anatomical structures in relation to implant surgery [11,25,26].

Evaluation of the thematic map analysis demonstrated that the terms "anterior loop," "inferior alveolar nerve," and "mental foramen" were located within the basic themes category and represented the main areas of interest in the literature. Although these themes occupied a central position, their development

remained limited, reflecting the fundamental direction of the literature. The term "life-threatening hemorrhage" was identified within the niche themes category, suggesting that this topic has become a more specialized research area in the literature, although its thematic importance may increase with future studies. Thematic evolution analysis indicated that early studies mainly focused on anatomical structures and implants, whereas cone beam computed tomography and radiological evaluation became more prominent in later years. This finding reflects the transformation of research areas in the literature associated with advancements in imaging techniques in dentistry.

The limitations of the present study include the use of only English keywords during the search process and the exclusion of publications indexed in databases other than WoSCC.

Conclusion

In conclusion, the mandibular incisive canal and the anterior loop of the mental foramen represent a continuously developing field of research. Due to advancements in imaging techniques in dentistry and the increasing use of implant applications, this topic constitutes an important area of interest in the literature. Future bibliometric studies are recommended to be conducted using broader databases and search terms in different languages.

Conflict of Interest

The authors declare no conflict of interest or financial support for this study.

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