

## Bibliometric Analysis of Scientific Studies on OSCE in Dental Education

### Diş Hekimliği Eğitiminde OSCE Üzerine Yapılan Bilimsel Çalışmaların Bibliyometrik Analizi

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#### ABSTRACT

**Objective:** This study aims to conduct a bibliometric analysis of the Objective Structured Clinical Examination (OSCE) in dental education to evaluate global trends and academic productivity. It investigates the distribution of scientific output, the most prolific institutions, authors, and journals, along with the most frequently used keywords and highly cited publications.

**Materials and Methods:** A comprehensive literature search was conducted in the Web of Science database using the keywords "OSCE" and "Dental Education." Bibliometric data were retrieved using the "Analyze Results" and "Citation Analysis" tools. Co-authorship and keyword co-occurrence networks were visualized with VOSviewer software. The number of publications, distribution by country and institution, citation counts, and keyword frequency were analyzed.

**Results:** A total of 112 publications were included. The leading countries were the USA, UK, Germany, Saudi Arabia, and Scotland. Harvard University and the University of London were the most productive institutions. Most OSCE-related articles were published in the *European Journal of Dental Education* and the *Journal of Dental Education*. Besides "OSCE" and "Dental Education," common keywords included "assessment," "objective structured clinical examination," and "dental students." The most cited paper was a 2008 review on predoctoral education practices.

**Conclusion:** This study offers a comprehensive overview of OSCE-related literature in dental education. It helps identify research trends, key contributors, and potential gaps, providing valuable insights for ongoing academic development and evidence-based education.

**Keywords:** Bibliometric Analysis, Dental Education, Objective Structured Clinical Examination

#### ÖZ

**Amaç:** Bu çalışmanın amacı, diş hekimliği eğitiminde kullanılan OSCE üzerine bibliyometrik bir analiz yaparak küresel eğilimleri ve akademik üretimi değerlendirmektir. Yapılan araştırmalara ilişkin bilimsel üretimin dağılımını, en çok yayın yapan kurum, yazar ve dergileri belirlemek, en sık kullanılan anahtar kelimeleri ve en çok atıf alan makaleleri açıklamaktır.

**Gereç ve Yöntemler:** Web of Science veritabanı kullanılarak kapsamlı bir literatür taraması yapıldı. "OSCE" ve "Dental Education" anahtar kelimeleri kullanıldı. Web of Science'in "Analyze Results" ve "Citation Analysis" araçları aracılığıyla bibliyometrik veriler çıkarıldı. Ortak yazarlık ve anahtar kelime oluşumuna ilişkin bibliyometrik ağlar, VOSviewer yazılım aracı kullanılarak gösterildi. Çalışmada yayımlanan makale sayısı, ülke ve kurum bazında dağılımı, atıf sayıları ve en sık kullanılan anahtar kelimeler değerlendirildi.

**Bulgular:** Analize toplam 112 makale dahil edildi. En fazla yayın yapan ülkeler Amerika Birleşik Devletleri, İngiltere, Almanya, Suudi Arabistan ve İskoçya olarak belirlendi. En üretken kurumlar arasında Harvard Üniversitesi ve Londra Üniversitesi öne çıktı. OSCE ile ilgili incelenen yayınların büyük bir kısmı *European Journal of Dental Education* ve *Journal of Dental Education* dergilerinde yayımlandı. OSCE ve Dental Education dışında en sık kullanılan anahtar kelimeler "assessment", "objective structured clinical examination" ve "dental students" olarak belirlendi. En çok atıf alan makale ise 2008 yılında yayımlandı.

**Sonuçlar:** Bu çalışmada literatürün bütüncül bir analizi elde edildi. Çalışma, diş hekimliği eğitiminde OSCE ile ilgili literatür taramasını kolaylaştırmakta ve akademisyenlerin sürekli eğitimine, kanıta dayalı uygulamalara katkıda bulunabilecek önemli noktaları ortaya koymaktadır.

**Anahtar Kelimeler:** Bibliyometrik Analiz, Diş Hekimliği Eğitimi, Yapılandırılmış Yansız Klinik Sınav

#### Introduction

Dentistry is predominantly a practice-based discipline.<sup>1</sup> During the preclinical phase, dental students undergo extensive theoretical and practical training to prepare for meeting their patients' needs and performing all essential therapeutic procedures.<sup>2</sup> Many dental faculties have adopted alternative educational strategies aimed at enhancing students' abilities in critical evaluation of knowledge, self-directed learning, and evidence-based decision-making.<sup>3</sup> Regular and comprehensive assessments are crucial to monitor students' progress and ensure competency upon graduation. Although written examinations are relatively straightforward, they may fall short in assessing the full range of clinical skills.<sup>1</sup> Outcome-based approaches in clinical assessment can overlook essential attributes such as communication, practical, and procedural skills.<sup>2</sup>

In an effort to assess clinical skills in a consistent and objective manner, the Objective Structured Clinical Examination (OSCE) model was introduced by Harden and colleagues in 1975.<sup>4</sup> OSCE is an innovative assessment method that evaluates not only factual knowledge but also effective communication and practical examination skills. As it is conducted in a lower-risk setting compared to real patient encounters, it allows students to feel more comfortable during the examination.<sup>5</sup> Numerous studies have demonstrated that OSCE is a valid and reliable tool for the assessment of clinical competencies.<sup>6,7</sup> It is an effective method for evaluating clinical and technical skills and achieving

knowledge- and skill-based educational objectives.<sup>8</sup> The literature frequently emphasizes that OSCE meets key quality standards expected from an examination, such as reliability, validity, and feasibility.<sup>9</sup> The OSCE has been widely used as an assessment tool in medicine and dentistry for over 40 years.<sup>10</sup>

Bibliometric analysis is an analytical method that enables the quantitative examination of research outputs within a specific field. This method allows for the investigation of trends, collaborations, and scientific productivity in the literature through visualization software.<sup>11</sup> Through bibliometric approaches, it is possible to identify publication types, the most productive authors, institutions, and countries. In addition, collaboration networks, gaps in the literature, and potential opportunities for future research can be determined. Bibliometric analyses also provide comprehensive insights by including data such as keywords and citation patterns. Citation analysis, in particular, is commonly used to evaluate the impact level of research.<sup>12</sup> Visualization tools such as VOSviewer (Centre for Science and Technology Studies, Leiden University, the Netherlands) facilitate the graphical representation of research areas by creating bibliometric maps.<sup>12,13</sup>

Bibliometric analyses have been conducted on various topics such as the most cited articles<sup>14</sup>, areas of interest<sup>15</sup> and the implementation of OSCE in pharmacy education.<sup>16</sup> Despite the presence of numerous clinical studies and reviews on OSCE in dental education, there is currently no study that evaluates the literature production in this field

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using bibliometric analysis and mapping methods. Therefore, the aim of this research is to conduct a comprehensive bibliometric analysis of the literature related to OSCE in dental education. This study aims to reveal the development and interaction networks of the literature in the field, identify leading institutions, authors, and countries, and define current research focuses and potential future directions through keyword analysis.

## Materials and Methods

### Database and Search Strategy

In this study, the Web of Science (WoS) electronic database provided by Clarivate Analytics (London, UK) was used. A comprehensive search was conducted within the Web of Science Core Collection using the advanced search feature. Boolean operators "AND" and "OR" were used to construct the following search query:

("OSCE" OR "Objective Structured Clinical Examination") AND "Dental Education"

### Data Extraction and Analysis

The data search was finalized as of January 28, 2025. The earliest relevant publication on the topic was from 2007, and the most recent one was published in 2024. For the bibliometric analysis, the "Analyze Results" tool of WoS was used to extract data including authors, journals, institutions, countries, publication years, keywords, number of citations, WoS categories, and research areas. Additionally, citation metrics such as total citation counts and average annual citations for the most cited publications were obtained using the "Create Citation Report" tool of WoS.

To support data visualization, bibliometric network maps were created using VOSviewer software (version 1.6.16). In this context, total records were analyzed, and co-authorship networks (by author, institution, and country) as well as keyword co-occurrences were visualized.

### Statistical Analysis

No comparative statistical analyses were conducted in this study. The results were presented as frequencies and percentages. Accordingly, no hypothesis testing was performed, and no significance level was set.

## Result

### General Information

A total of 112 publications were included in the analysis (107 articles, 3 review articles, and 2 early access papers). The number of publications per year showed little variation before 2016. However, starting from 2018, a general upward trend was observed, with the highest number of publications reached in 2020 (Figure 1).

These publications received a total of 1389 citations, with an average of 12.4 citations per article. The annual number of citations showed little change before 2019 but exhibited a general increase thereafter, peaking at 188 citations in 2024 (Figure 1).

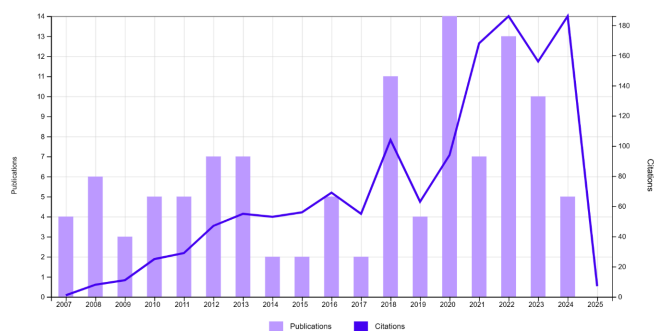


Figure 1. Total number of articles and citations by year

### Leading Journals and Keywords

The top two journals in terms of the number of publications on the subject were the *European Journal of Dental Education* and the *Journal of Dental Education*, each contributing 43 articles. Together, these two journals accounted for 86 publications, representing 76.8% of the total. The number of citations for articles published in these journals was 526 (15.09 citations per article) and 471 (13.28 citations per article), respectively.

The most frequently used keywords were visualized in Figure 2. Following "dental education" and "OSCE," the most common keywords included "assessment," "objective structured clinical examination," and "dental students."

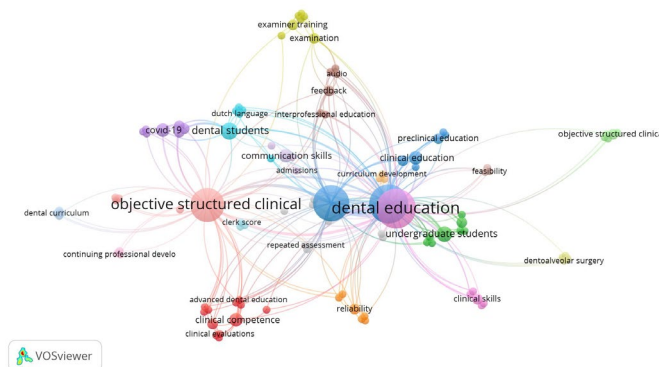


Figure 2. Visualization of the most frequently used keywords

### Countries and Institutions

The top five countries in terms of the number of published articles are listed in Table 1. Among these, the United States of America (USA) ranked first in terms of publication count (39), total number of citations received (553), and total link strength (107) (Figure 3). The top five institutions by publication count were Harvard University, University of London, Academic Center for Dentistry Amsterdam, Vrije Universiteit Amsterdam, and National Taiwan University.

Table 1. The top five countries by number of published articles

Countries	Number of Publications	
1	USA	39
2	England	16
3	Germany	12
4	Saudi Arabia	9
5	Scotland	9

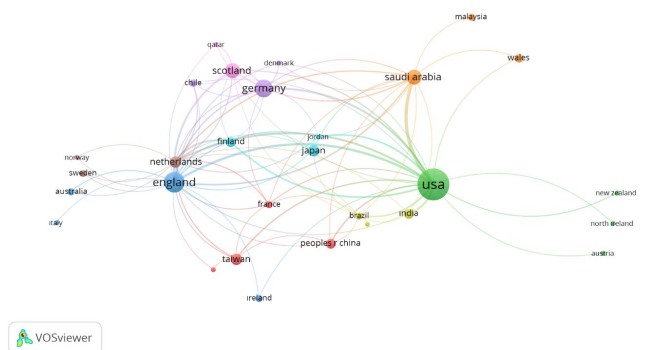


Figure 3. Visualization of international collaboration based on the number of published articles by country

Authors

A total of 470 authors contributed to the 112 publications evaluated. The top five authors in terms of the number of published articles are presented in Table 2. Schoonheim-Klein M ranked first in terms of number of publications (6), number of citations received (209), and total link strength (27) (Figure 4)

Table 2. Top five authors by number of published articles

Authors	Number of Publications
1	Schoonheim-Klein, M.
2	Karimbux, Nadeem Y.
3	Manogue, Michael
4	Lahti, Satu
5	Lai, Eddie Hsiang-Hua

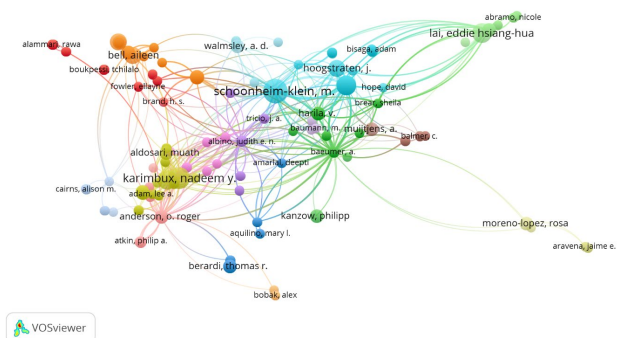


Figure 4. Visualization of citation counts by authors

Articles

The top five most cited articles are presented in Table 3. The article with the highest total number of citations was published in 2008 and was a review investigating current practices in predoctoral dental education. Table 4 presents the top five articles ranked by average annual citation count. The article with the highest average annual citation was published in 2020 and addressed the implementation and evaluation of an online examination for final-year dental students during the COVID-19 pandemic.

Table 3. The top five most cited articles

	Title	Author	Year of publication	Total Citation
1	Assessing Dental Students' Competence: Best Practice Recommendations in the Performance Assessment Literature and Investigation of Current Practices in Predoctoral Dental Education <sup>31</sup>	Albino, J.	2008	123
2	Is the OSCE more stressful? Examination anxiety and its consequences in different assessment methods in dental education <sup>32</sup>	Schoonheim-Klein, M.	2009	104
3	Introducing a comprehensive high-stake online exam to final-year dental students during the COVID-19 pandemic and evaluation of its effectiveness <sup>28</sup>	Khalaf, K	2020	56
4	The correlation of student performance in preclinical and clinical prosthodontic <sup>33</sup>	Curtis, Donald A.	2007	53
5	Implementing an online OSCE during the COVID-19 pandemic <sup>34</sup>	Kakadia, Rahen	2021	51

Table 4. Top five articles by annual average citation frequency

	Title	Author	Year of publication	Citation frequency
1	Introducing a comprehensive high-stake online exam to final-year dental students during the COVID-19 pandemic and evaluation of its effectiveness <sup>28</sup>	Khalaf, K	2020	
2	Implementing an online OSCE during the COVID-19 pandemic <sup>34</sup>	Kakadia, R	2021	
3	Assessing Dental Students' Competence: Best Practice Recommendations in the Performance Assessment Literature and Investigation of Current Practices in Predoctoral Dental Education <sup>31</sup>	Albino, J.	2008	
4	Is the OSCE more stressful? Examination anxiety and its consequences in different assessment methods in dental education <sup>32</sup>	Schoonheim-Klein, M	2009	
5	A pilot of a Virtual Objective Structured Clinical Examination in dental education. A response to COVID-19 <sup>35</sup>	Donn, J.	2021	

Discussion

Bibliometric studies not only provide an overview of the historical background of a particular subject but also help to identify its evolution over time and highlight emerging research interests in the field.<sup>17</sup> Bibliometric analyses may focus on the evaluation of a single publication<sup>18</sup> or a group of publications.<sup>19</sup> Similarly, they can also be directed toward examining the scientific output of a specific country or research area.<sup>20</sup> This study aimed to comprehensively understand the prevailing academic landscape related to OSCE in dental education. By analyzing relevant research articles, a holistic evaluation of the literature was obtained.

Regarding the use of specific databases, selecting an appropriate source is essential for accurate and reliable data analysis.<sup>21</sup> Citation indexes such as WoS, Scopus (Elsevier, Amsterdam, Netherlands) and Medline (National Library of Medicine; National Institutes of Health, Bethesda, MD, USA) are among the most commonly used databases in health sciences due to their broad thematic and geographical coverage. Therefore, a comprehensive search was conducted in the Web of Science database for this study. A total of 112 publications authored by 470 researchers from 156 institutions in 34 countries were included. This distribution indicates that the topic of OSCE in dental education has attracted global attention and scientific interest. The first publication related to the topic appeared in 2007, and the number of publications peaked in 2020. This suggests that the subject remains current and that there are many aspects that still require further development.

When examining the geographical distribution of author affiliations, it is noteworthy that the United States (USA) emerged as the most productive country in terms of the number of published articles, total citations, and the highest total link strength. Total link strength indicates the degree of collaboration.<sup>22</sup> This suggests an increasing collaborative engagement within the U.S. scientific community. It has been reported that dental schools in North America began using the OSCE as early as the 1970s, and this approach later served as a model for educational institutions worldwide.<sup>23</sup> Additionally, the high-budget academic infrastructure of USA based universities and their access to leading scientific journals may contribute to the quantitative and qualitative prominence of publications from this country.<sup>24</sup> Therefore, the strong research infrastructure in dental education, the volume of scientific output, and the early adoption of OSCE as a clinical assessment tool may explain the USA's leading position.

While the number of publications indicates researcher productivity, citation counts are used to evaluate scientific impact by measuring how frequently a particular study is cited in subsequent publications.<sup>25</sup> In this study, the author Schoonheim-Klein, M. ranked first in terms of the number of publications, total citations, and total link strength. Citation analysis is a commonly used method in bibliometric studies to assess the impact of a publication based on how often it is cited by other authors.<sup>26</sup> An important consideration in citation analysis is that older publications tend to accumulate more citations in absolute terms over time.<sup>27</sup> However, this is not always the case. In the present study, the most cited article was published in 2008, whereas the article with the highest average annual citation rate was published in 2020.<sup>28</sup> The high annual citation intensity of the article titled "Introducing a comprehensive high-stake online exam to

*final-year dental students during the COVID-19 pandemic and evaluation of its effectiveness*” may be attributed to the emergence of online OSCE implementations during the COVID-19 pandemic and the growing research interest in this area.

The journal analysis revealed that the leading journals in this field not only published the highest volume of literature but also received the greatest number of citations.<sup>29</sup> This finding indicates that these journals have consistently maintained their authority as prominent sources in the field of dental education. The co-occurrence analysis of keywords can provide insight into the evolving patterns of a specific research area.<sup>30</sup> The results of the keyword analysis highlighted several notable research foci within the topic.

This study has certain limitations. Only the Web of Science (WoS) database was used, and only English-language publications were included. Additionally, early access articles identified by WoS that had not yet been assigned a volume, issue, or page number were also included, which may be considered a limitation. Future studies may benefit from including other databases such as Scopus and Medline

### Conclusion

This bibliometric analysis comprehensively evaluated the global distribution, research trends, and collaboration networks of scientific publications on the OSCE in dental education. The findings indicate that OSCE has been increasingly adopted worldwide as a tool for clinical skills assessment and has regained attention particularly through online implementations in the post-COVID-19 period. USA emerged as the leading country in terms of the number of publications, citation count, and total link strength, which may be associated with its strong academic infrastructure and early adoption of OSCE. This study highlights the evolution and current focus areas of the OSCE-related literature and offers strategic insights to guide future research.

### Değerlendirme / Peer-Review

İki Dış Hakem / Çift Taraflı Körleme

### Etik Beyan / Ethical statement

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This study was presented as an "oral presentation" at the UDEG 3rd International Dentistry Education Congress held at Bolu Abant İzzet Baysal University on 20-22 February 2025.

It is declared that during the preparation process of this study, scientific and ethical principles were followed and all the studies benefited are stated in the bibliography.

### Benzerlik Taraması / Similarity scan

Yapıldı - ithenticate

### Etik Bildirim / Ethical statement

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### Çıkar Çatışması / Conflict of interest

Çıkar çatışması beyan edilmemiştir.

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Veri Toplanması/ Data Acquisition: SBÖ(%60), BÖ(%40)

Veri Analizi/ Data Analysis: SBÖ(%50), BÖ(%50)

Makalenin Yazımı/ Writing up: SBÖ(%50), BÖ(%50)

Makale Gönderimi ve Revizyonu/ Submission and Revision: SBÖ(%40), BÖ(%60)

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