Review Article

Iran's Significant Advances in Orthognathic Surgery Research

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ABSTRACT

Background: The aim of this article was to perform a bibliometric analysis of Iranian researchers in orthognathic surgery.

Methods: A bibliographical search for orthognathic surgery literature on Iran was conducted on Wef of Science. Mendeley and Microsoft Excel were used for tabulation and data visualization. Some statistical tests were performed with a 95% confidence interval, considered significant.

Results: From 7,535 articles, 86 included at least one Iranian author, making Iran the second highest contributor in the Middle East after Turkey. Notable topics beyond orthodontic treatment included cosmetic surgery, obstructive sleep apnea, blood clotting, and anesthesiology, with complications being the most studied. Emerging themes were Virtual Surgical Planning and technology. Statistical analysis showed a very high Pearson correlation between the number of ranked institutions and both the number of published articles (ρ=0.85) and the quantity of citations (ρ=0.80), and a moderate correlation with the H-index (ρ=0.46). No correlation was found between citations per document and the number of ranked institutions (ρ= -0.27).

Conclusion: Iran is a leading country in the field of orthognathic surgery, both regionally and globally. This article provides valuable insights for Iranian researchers and academics, highlighting the potential of international collaboration and free open-source technology to advance knowledge in areas like Virtual Surgical Planning. Promoting global partnerships and utilizing innovative technologies can enhance patient outcomes and benefit practitioners in resource-limited regions worldwide.

KEYWORDS
Bibliometrics; Orthognathic surgery; Iran; Middle East

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INTRODUCTION

Historical records reveal that during the era of traditional medicine, ancient Iranian scholars at Jundishapur University and later in post-Islamic medicine made significant contributions to oral surgery[1]. However, a more structured approach to orthognathic surgery in Iran, dates back to the mid-20th century, marking the beginning of a journey that has seen significant advancements and contributions to the field [2].

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Orthognathic surgery is particularly critical in Iran due to the high prevalence of severe dentofacial deformities, such as Class III malocclusions and Class II skeletal patterns [3]. Studies have estimated the prevalence of severe dentofacial deformities needing orthognathic surgeries being between 2%-8% of the population [4]. Of the orthognathic surgeries performed, bimaxillary osteotomy was the most prevalent procedure, accounting for 66% of surgeries [5]. The distribution of malocclusions shows a substantial impact on both jaws, especially in Class III subjects, indicating a widespread need for comprehensive surgical intervention [5].

In Iranian society, there is a strong cultural emphasis on facial aesthetics and harmony, making the outcomes of orthognathic surgery critically importante [6]. The desire for improved appearance and function drives the demand for high-quality surgical results. This cultural perception amplifies the significance of achieving precise and effective surgical interventions, as patients have high expectations for both functional and cosmetic improvements post-surgery [7]. As a result, Iranian surgeons are motivated to adopt the latest techniques and technologies to meet these expectations and ensure optimal patient satisfaction.

Iranian surgeons have made several important innovations in the field of orthognathic surgery, contributing significantly to its advancement. One such innovation is the integration of 3D printing technology, which has revolutionized maxillofacial surgery by providing unprecedented precision in surgical planning and execution [8]. Other contributions of Iranian surgeons include advancements in surgical approaches, anesthesia management to reduce postoperative nausea and vomiting, and the development of more effective postoperative care protocols[9].

In addition to technological innovations, Iranian researchers have made substantial contributions through extensive scholarly activity. Bibliometric analyses of Iranian research in orthognathic surgery indicate a growing impact and presence in the global medical community. These contributions not only enhance the understanding of complex surgical procedures but also highlight Iran's role as a leader in medical research and innovation in the region.

Given these considerations, conducting a bibliometric analysis of orthognathic surgery research is crucial for comprehensively understanding the scope and impact of contributions made by Iranian researchers.

MATERIALS AND METHODS

This study adheres to the principles outlined in the Leiden Manifesto [10]. A literature review was conducted on the same day using Web of Science (WoS) to avoid bias. The search performed was "orthognathic surgery", including only articles authored by at least one Iranian researcher. Two authors (SS and RG) agreed on inclusion and exclusion criteria, resolving any disagreements by consensus. Recent studies were used for data comparison. Exclusion criteria included (1) articles not indexed on WoS, (2) articles unrelated to oral surgery, and (3) specific types of articles such as abstracts only, retracted articles, event calendars, conference papers, and book reviews. A secondary search was performed regarding university numbers in SJR (https://www.scimagojr.com/).

Data collected were manually entered into Mendeley software (Elsevier, London, UK). Bibliometric measures were compiled to evaluate the retrieved data. Microsoft Excel (Microsoft Corp. Redmond, WA, USA), was used to gather and analyze data from WoS. Indicators such as authors' h-index were obtained through WoS. Journals that had undergone name changes were consolidated into a single entity. Descriptive statistics were used to describe specific features, and statistical analyses were conducted with a 95% confidence interval. As this article is a bibliometric analysis, it is exempt from institutional review board approval since it only relied on publicly available electronic sources and did not generate new data or report specific patient data.

RESULTS

From 7,535 articles, 86 were included with at least one Iranian author. Of Middle Eastern countries, it poses as second only after Turkey (n=204). These 86 articles were cited 844 times with an average of 9.81 per article. Overall, 725 cited these articles reaching an H-index of 16. The most cited article was "*Treatment decision in adult patients with class III malocclusion: surgery versus orthodontics*" [11] with 63 citations. Mashhad University of Medical Sciences leads in institutional affiliation with 20 publications on this topic, followed by Islamic Azad University and Tehran University of Medical Sciences, with 19 each.

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The number of Iranian publications on orthognathic surgery is increasing with a mild exponential uptrend over the years (R^2=0.3308) (Figure 1). Overall, 27 different journals were retrieved. Journal of Craniofacial Surgery was the leader (n=22) [12–33], followed by Journal of Oral and Maxillofacial Surgery (n=14) [34–47], International Journal of Oral and Maxillofacial Surgery (n=7) [48-54], British Journal of Oral and Maxillofacial Surgery [55–60] and Journal of Stomatology Oral and Maxillofacial Surgery [61–66] (n=6, each) and Journal of Craniomaxillofacial Surgery (n=4) [67–70]. The average impact factor of the included articles was 1.96.

Beyond orthodontic treatment (n=38), interesting citations topics correlated were cosmetic surgery (n=8), obstructive sleep apnea (n=5), blood clotting (n=5) and anesthesiology (n=4). Ten topics were retrieved (Figure 2). Complications was the more common studied topic [12,13,22,25,42,51,53,55,56,60,65,66,69,71–78]. Virtual Surgical Planning [79–81] and technology [82,83] are emerging themes.

Statistical analysis of data from SJR revealed a very high Pearson correlation between the number of ranked institutions and the number of published

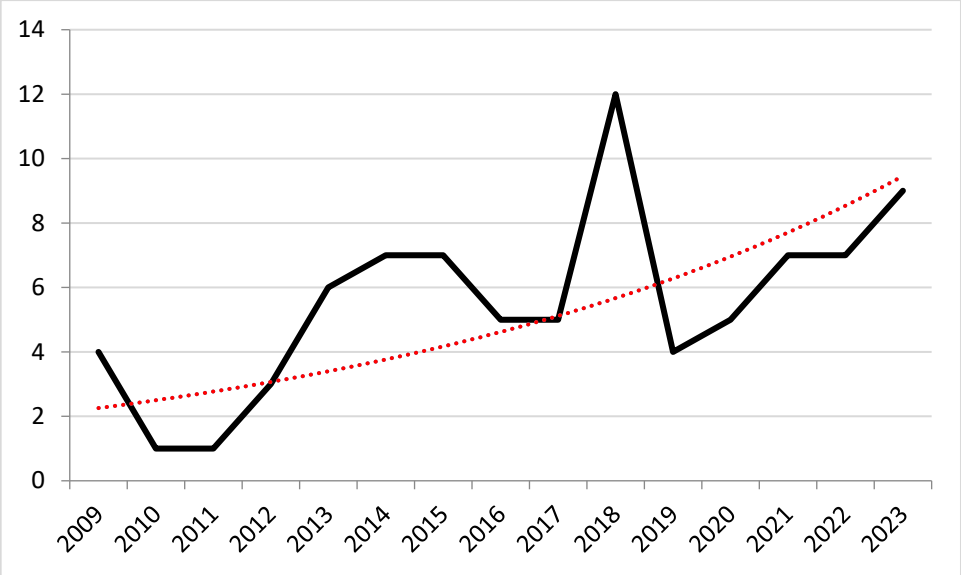

Figure 1. Number of publications (Y) over the years (X). Upward trend exponential line in red

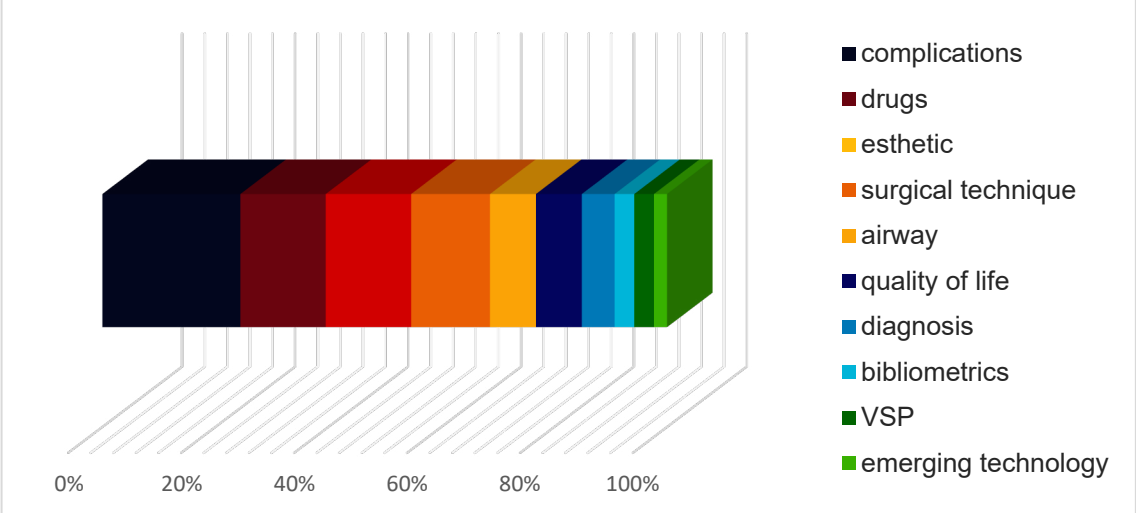

Figure 2. Main topic retrieved manually from articles where it is possible to notice interest in different subjects related to orthognathic surgery with prevalence to complications and use of helpful drugs.

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articles (ρ=0.85; *P*<0.00001), as well as the quantity of citations (ρ=0.80; *P*<0.00001). A moderate correlation with the H-index was found (ρ=0.46; *P*<0.00001). No correlation was found between the number of citations per document and the quantity of ranked institutions (ρ= -0.27; *P*<0.00001).

DISCUSSION

Geographic bibliometrics plays a crucial role in understanding and fostering international collaboration. By analyzing publication trends across different regions, researchers can identify key areas of expertise, emerging research hubs, and opportunities for cross-border partnerships. This is particularly beneficial for low and middle-income countries (LMICs), which often face resource constraints and limited access to cutting-edge technology. International collaboration enabled by geographic bibliometrics can bridge these gaps, facilitating knowledge transfer, capacity building, and the sharing of best practices [61]. Collaborative efforts can also attract funding and improve the visibility and impact of research from LMICs, contributing to a more equitable global scientific community [84].

Publications regarding orthognathic surgery face a challenge due to the high cost of the surgery and the time-intensive nature of surgeon training, which involves a long learning curve. Articles on other topics related to OMFS, such as oral surgery, maxillofacial trauma, cleft lip and oral pathology, are more common in LMICs [61,84]. Complications associated with orthognathic surgery are considered a very interesting topic [85]. While complications and effective medications during the perioperative period are the main subjects published, there is an emerging trend in publications about Virtual Surgical Planning (VSP) and new technologies. This underscores the significance of Iranian surgeons in adopting and creating new technologies related to orthognathic surgery. The democratization and spread of free and open-source software tend to decrease the gap among LMICs. Learning and training on non-specific software such as Blender, Meshmixer, and 3D Slicer, though challenging, present a tremendous opportunity to bring technology to these regions.

The number of articles associating orthognathic surgery with rhinoplasty and other cosmetic surgeries highlights the growing concern for facial aesthetics. Cosmetic procedures can be considered important adjuncts to orthognathic surgery to enhance facial harmony.

The presented data, focusing on Iran, reveal significant insights into the country's research landscape in OMFS field. The very high Pearson correlation coefficients between the number of ranked institutions and both the number of published articles (ρ = 0.85) and the quantity of citations (ρ = 0.80) indicate robust research output from Iranian institutions, suggesting substantial contributions to the volume and impact of OMFS research. The moderate correlation with the H-index (ρ = 0.46) reflects a relationship between institutional ranking and research quality, though other factors like collaboration and funding also play roles. Notably, the lack of correlation between citations per document and the quantity of ranked institutions (ρ = -0.27) suggests that impactful research can emerge from various institutions, not just the highly ranked ones. These findings highlight the strong foundation of Iranian OMFS research and the potential for further enhancement through increased international collaboration, visibility, and investment in advanced technologies.

As stated before, no economic index can be associated with the number or quality of publications [61]. Although the volume of publications is not high, their quality is notable, with most being published in well-regarded specialized OMFS journals. This highlights the importance of orthognathic surgery and its continuous advancements for Iranian authors and surgeons.

CONCLUSION

Iran is a prolific country in the field of orthognathic surgery, not only in the Middle East but also worldwide. This article serves as a valuable resource for Iranian authors, researchers, and academics. International collaboration and widespread education, along with the use of free and open-source technology, could significantly enhance knowledge in emerging topics such as Virtual Surgical Planning. By fostering global partnerships and leveraging innovative technologies, Iranian researchers can continue to make substantial contributions to the field, addressing complex clinical challenges and improving patient outcomes.

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Additionally, the sharing of open-source resources can democratize access to advanced surgical planning tools, benefiting practitioners and patients in resource-limited settings globally.

ETHICAL APPROVAL

This is a bibliometric analysis. No ethical approval is required.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

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