

# Bibliometric Analysis of the Scientific Production in Contemporary Orthognathic Surgery in the Maxillofacial Surgery Department of the Pontificia Universidad Católica De Río Grande Del Sur/Hospital San Lucas Porto Alegre/Brazil

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## Keywords

Contemporary Orthognathic Surgery, Orthognathic Surgery, Bibliometric analysis, Virtual planning, Minimally Invasive (MI) Orthognathic Surgery, Artificial Intelligence, Bibliometrics.

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## Objective

The objective of this analysis was to learn about the current situation and the critical points of research in the field of contemporary orthognathic surgery from the publications and collaborations of Dr. Orion Luiz Haas Junior, of the department of Maxillofacial Surgery of the Pontificia Universidad Católica de Río Grande del sur, Brazil.

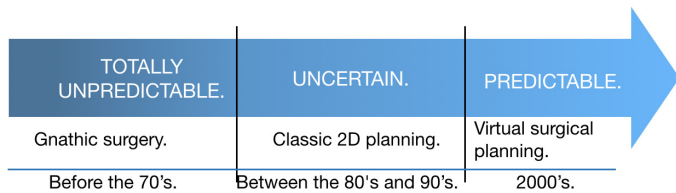
## Background

Elegaard and Wallin show a significant increase in the use of bibliometric analysis, especially outside of the ambit of the information and library science (ILS). Although the articles on bibliometrics are cited more often within the ILS community, the interest in other scientific disciplines such as medicine, engineering, and computer sciences is growing. Bibliometric analysis is becoming a relevant tool for evaluating and following scientific production in several disciplines [1]. Grillo presents a bibliometric analysis of the 100 most cited articles on orthognathic surgery. A retrospective in Google Scholar and Dimensions with the term “orthognathic surgery” was carried out, evaluating the number of citations, citations per year, authors, and year of publication. The resulting

list was organized according to the number of citations in Google Scholar. The results highlighted themes such as virtual planning and complications in orthognathic surgery, with a growing interest in the relationship between surgery and obstructive sleep apnea [2]. Hernández-Alfaro and Guijarro-Martínez analyze the evolution of orthodontic treatments and orthognathic surgery, proposing six surgical intervention schedules: “surgery first,” “surgery early,” “surgery late,” “surgery last,” “surgery only,” and “surgery never.” “Surgery late” is the most common, while “surgery first” and “surgery early” are preferred for aesthetic reasons. “Surgery only” is used mainly for treating sleep apnea, and “surgery last” applies to patients who want better aesthetics after compensatory orthodontics [3]. Then these authors analyzed 10 years of experience focusing on “surgery first” (SF) in orthognathic surgery. They update concepts such as indications, contraindications, virtual planning, surgical techniques and the benefits of late orthodontic treatment. SF is adequate for patients who want immediate aesthetic results, a short orthodontic treatment, or treatment of respiratory sleep disorders, provided that they meet the criteria. Virtual planning is crucial for predicting final occlusion and designing the necessary surgical movements [4]. The first osteotomies for correcting dentofacial deformities

were performed in the early 1920s. They were done without prior orthodontic treatment, since there had been no effective treatment for correcting dental arches, so the results obtained were unstable, aesthetically deficient and unpredictable. Over time, various surgical planning methods have been described using new technologies and artificial intelligence. These have improved surgical predictability, reduced operating times, and achieved a reduction in transoperative complications Figure 1.

**Figure 1:** Predictability of orthognathic surgery through time.



### Methodology

This investigation began by compiling publications from the Scopus profile of the author of interest. No restrictions were applied in terms of language or other filters to ensure the inclusiveness of

the document selection. A total of 42 publications were analyzed of diverse branches of the maxillofacial surgery by the author Orion Luiz Haas Junior between 2009 and 2024, of which 29 publications related to contemporary orthognathic surgery were included Graph 1.

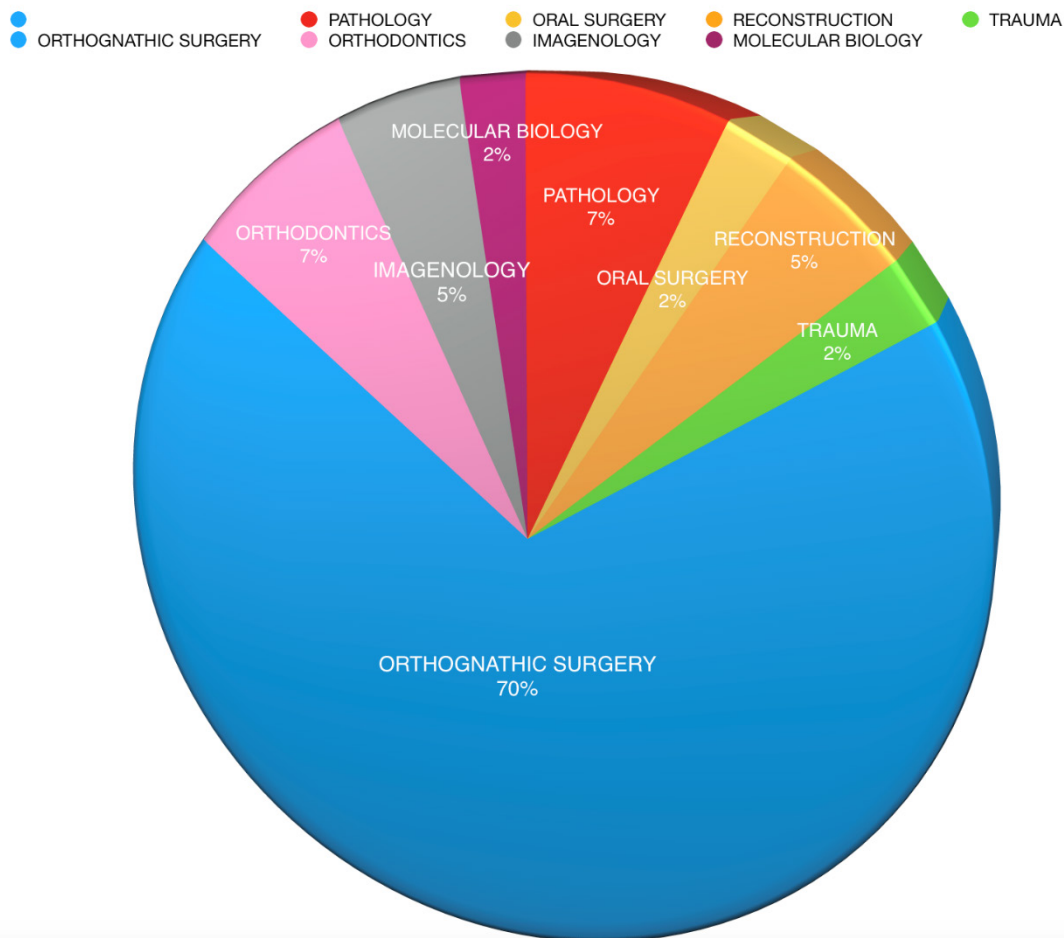
Then they were classified according to type of study. Graph 2. The results were analyzed in ATLAS.ti and VOSviewer software, which also carried out an analysis of citations, analysis of citation networks, analysis of productivity, and author visibility.

### Bibliometric Analysis

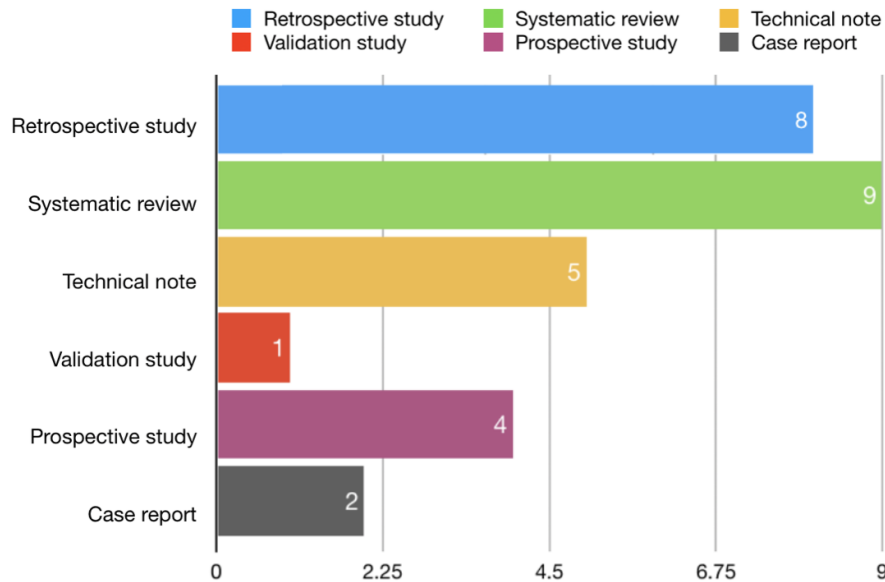
An analysis of the author's scientific production was carried out in terms of production, co-authors, methodology and journals in which they were published. The identification of emerging patterns and key points were done by selection specific categories, such as "Author," "Country," "Institution," and "Key Word" in each iteration.

### Statistical Analysis

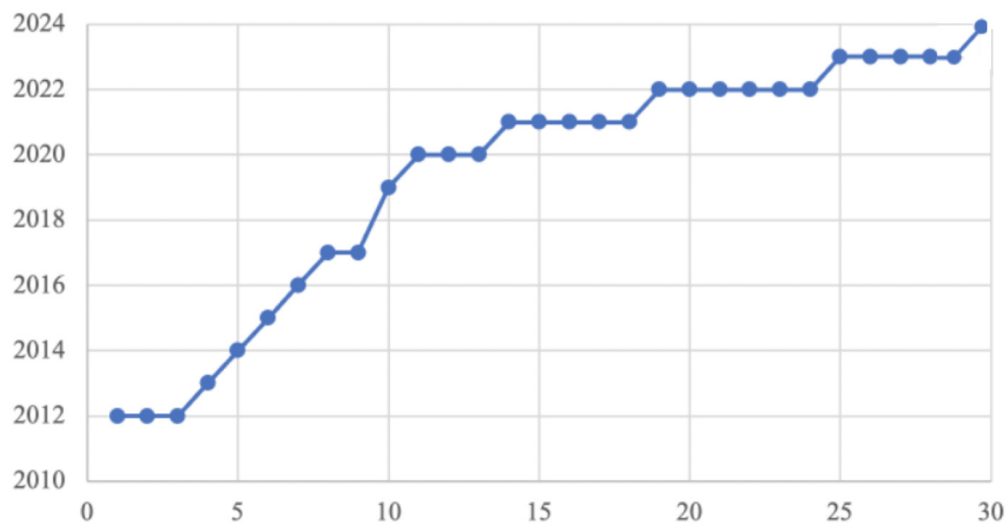
In the interpretation of the results, numerical and percentage forms were mainly used. This precise statistical approach facilitated the quantitative description of the author's output, providing a solid



**Graph 1:** Percentage of publications in various branches of maxillofacial surgery.



**Graph 2:** Main types of studies carried out by the author.



**Graph 3:** Analysis of the yearly volume of publications.

*Note:* Each node represents an article. The frequency of articles is shown on the X axis, and the year of publication on the Y axis.

base for analysis and interpretation of the collected bibliometric information.

### Qualitative Analysis

Qualitative analysis was carried out through the Atlas.ti software tool, which facilitated the efficient management of the documents. The coding was done using a mixed approach, combining the experience of the researcher with the enhancement of artificial intelligence techniques. Relevant thematic codes were established to capture the diversity of contents in the documents.

Atlasti facilitated the identification of emerging patterns and trends through advanced functions of visualization and data clustering. The analysis of relationships between codes permitted a deeper

understanding of the recurring interconnections and themes present in the documents analyzed.

### Results

The study reviewed 29 articles in which Dr. Orion Luiz Haas Junior appears as an author, analyzing output per year, the co-authors, and the journals in which the research was published, as well as the contents of each article, taken from IA.

#### Analysis of the Annual Volume of Publications

The investigation focused on the analysis of yearly volume of publications, revealing significant patterns of scientific production. The results show constant production of articles through the years, with a discernable trend toward an increase in yearly publication

output. Meticulous observations of the temporal evolution showed that the most prolific year was 2022, during which a total of six articles published by Dr. Haas were recorded. These findings are displayed graphically in Graph 3, providing a clear visual representation of the temporal dynamic of the author’s scientific production.

### Analysis of co-authors and institutions

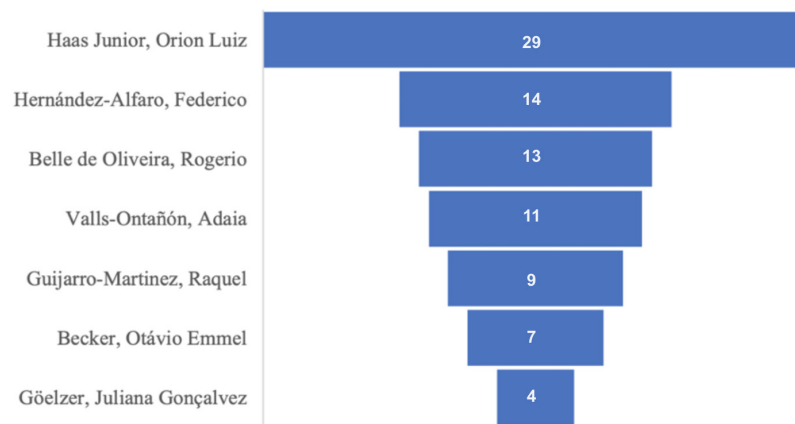
There were 50 co-authors in the 29 articles of Dr. Haas. Dr. Haas is affiliated with the Pontificia Universidade Católica de Río Grande del Sur in Brazil. His network of collaboration, according to the articles reviewed, mainly consists of Dr. Federico Hernández-Alfaro, who is affiliated with the Universidad Internacional de Cataluña in Spain; Dr. Rogerio Belle de Oliveira of the Pontificia Universidad Católica de Río Grande del Sur in Brazil; Dr. Adaia Valls Ontañón of the Barcelona Children’s Hospital Saint Joan de

Déu of Spain; Dr. Raquel Guijarro-Martínez, in the Swiss Concept Facial Clinic of Spain; and Drs. Otavio Emmel Becker and Dr. Goelzer, Juliana Goncalvez, both from the Pontificia Universidad Católica do rio Grande do Sul in Brazil Figure 2,3.

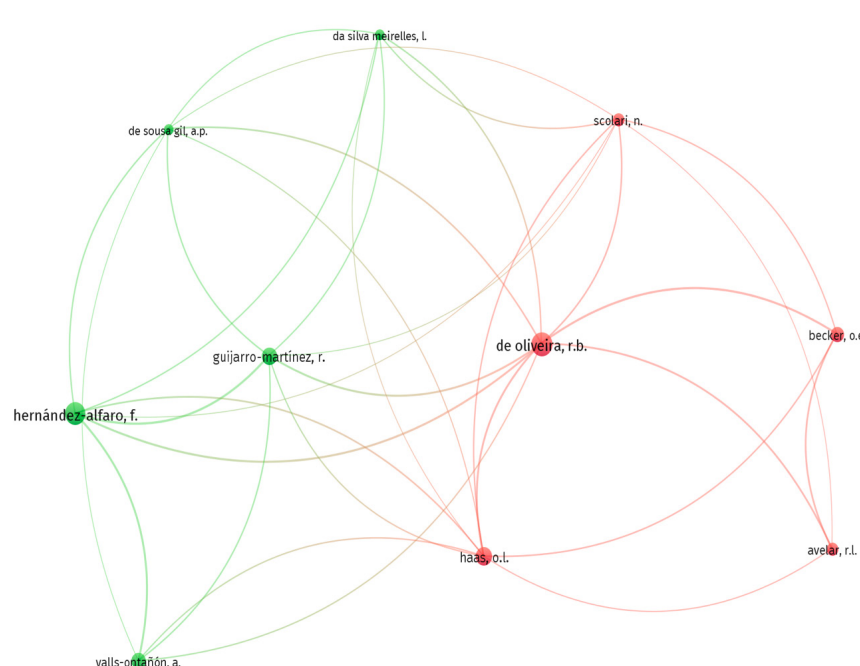
This analysis reveals that half (3) of the most frequent co-authors of Dr. Haas (a total of 6) share nationality and affiliation with him, while the other half (3) consist of authors from the European Community. This finding shows the diversity of international collaborations of Dr. Haas in building his research network.

### Analysis of journals

The analysis of journals reveals patterns in the choice of publications (table 1), which identifies the “International Journal of Oral and Maxillofacial Surgery (IJOMS)” as the most frequent journal, with 10 appearances. Being in quartile 1 and having an



**Figure 2:** Representation of the frequency of author appearance in all of the articles reviewed.



**Figure 3:** Bibliometric analysis of co-authorship, showing the authors who collaborated in the contemporary orthognathic surgery research. The colors indicate different study groups and the size of the circles the number of publications.

impact factor of 0.88 identifies it as a high-impact journal in the field of maxillofacial and oral surgery. As well, the “British Journal of Oral and Maxillofacial Surgery” also shows relevance, with a frequency of 3 and quartile 2, although its impact factor is smaller (0.55). In contrast, the “Journal of Cranio-Maxillofacial Surgery” and “Journal of Craniofacial Surgery” have sizable frequencies (3 each), but they lack information on quartiles and impact factors, which limits the evaluation of their relevance.

The “Journal of Oral and Maxillofacial Surgery,” despite having a lower frequency (2), remains influential with quartile 3 and an impact factor of 0.4. The choice of the “Aesthetic Surgery Journal” indicates an incursion into aesthetic surgery, backed up by its quartile 1 and a high impact factor of 1.2.

Journals like “Dentomaxillofacial Radiology” and the “International Journal of Surgery Case Reports,” with quartiles 1 and 3 respectively, show a focus on maxillofacial radiology and the presentation of surgical cases. Although the frequency of a publication may be minor, the impact factor provides an indication of influence in its specific fields.

Lastly. “Oral med, Ora path & Oral surg” shows with quartile 2 and an impact factor of 0.59, indicating its importance in the area of oral medicine and bucal pathology. Taken together, this diversity in the choice of journals suggests a balanced strategy to arrive at diverse audiences, and to contribute to different areas within maxillofacial surgery.

**Table 1:** Analysis of journals and their impact.

Magazine	Frecuence	Quartile	Impact factor
International journal of oral and maxillofacial surgery	11	1	0.88
British Journal of Oral and Maxillofacial Surgery	3	2	0.55
Journal of cranio-maxillo-facial surgery	3	*	*
Journal of craniofacial surgery	3	*	*
Journal of oral and maxillofacial surgery	2	3	0.4
Aesthetic Surgery Journal	1	1	1.2
Dentomaxillofacial radiology	1	1	0.87
International Journal of Surgery Case Reports	1	3	0.19
Journal of Oral and Dental Care	1	*	*
Journal of Stomatology oral and maxillofacial surgery	1	2	0.51
L` Orthodontie Française	1	*	*
Oral med. Oral pat & Oral surg	1	2	0.59

### Qualitative Analysis

The procedure began with an analysis of word frequency, followed by eliminating terms that did not reflect essential concepts. The result of this process is shown in the graphic representation of a cloud of words, shown in Figure 4.



**Figure 4:** Analysis of Word frequency.

In the center and highlighted by their larger size are the concepts that recur and that are fundamentally used by the author, among which are “patient,” “surgery,” “movement,” “tissue,” “stability,” and “osteotomy.” These key terms not only reflect the centrality of certain themes in the author’s works, but also provide a striking view of the preeminent thematic approaches in the research.

Next, artificial intelligence was used to codify the 29 articles in order to efficiently and objectively identify the central themes and concepts Figure 5.

This strategy proved to be especially effective in codifying, revealing that the most frequent category was “research methodology,” with 262 associated citations, followed by “surgical procedures” (229 citations), “medical evaluation” (202 citations), “Orthodontics” (173 citations), “3D imaging” (139 citations), and “maxillofacial surgery (119 citations). These results provide a comprehensive understanding of the predominant thematic areas in the scientific production.

Within the methodology category, a diversity of approaches was observed that relate to the production, including systematic reviews and meta-analyses, retrospective studies, randomized clinical trials, and longitudinal studies.

This robust methodological approach contributes to the quality and diversity of the research in the field of orthognathic surgery.

By exploring the themes researched in the context of orthognathic surgery, crucial aspects are addressed, such as stability of movement of the jaws, airway analysis, dental devices, sleep apnea, changes in soft tissues, and cosmetic surgery, to name a few. These



**Figure 5:** Thematic categories: The frequency shown in each box reflects the number of times, in all of the articles, in which the category and theme were addressed.

findings suggest a breadth of variables considered in diverse areas related to orthognathic surgery, supporting the multidisciplinary and complexity inherent in this field of research [4-20].

### Main Takeaways from Contemporary Orthognathic Surgery

Systematic review of computer-assisted planning (CAD-CAM) in orthognathic surgery is precise. As well, CAD-CAM reduces pre-operative planning time and improves the precision of surgical outcomes [5]. Granular biomaterial (Bio-oss) in bone grafts during a maxillary segmented osteotomy [6]. The stability and complications of the Le Fort 1 segmented osteotomy was analyzed in 23 studies with 2,594 patients. The results indicated that two-segment osteotomy is more stable than the three-segment one, and that the technique is useful for three-dimensional maxillary deformities corrections [7]. Surgical technique for controlling the nasal changes post-osteotomy Le Fort 1. The proposed approach includes an interalar suture and V-Y mucosal closure to reduce nasal base widening and shorten the upper lip [8]. Systematic review of alveolar corticotomies for accelerated orthodontics, evaluating their effectiveness in reducing treatment time and the need for extractions [9]. Stability of orthognathic surgery, evaluating 15 studies. The procedures are classified in four levels of stability, according to the relapse percentage: highly unstable (75-100%); unstable (50-74%); stable (25-49%); and highly stable (0-24%). It concluded that the maxillary procedures are generally less stable than the mandibular ones; rigid internal fixation and the

BSSO technique improve stability [10]. Systematic review of three-dimensional changes in nasolabial soft tissues following a Le Fort 1 osteotomy. Of 333 studies analyzed, only 17 met the inclusion criteria [11]. The precision of a voxel-based overlay protocol for cone beam computed tomography (CBCT) was investigated, using Dolphin 3D Imaging software [12]. A systematic review and meta-analysis of the maxillomandibular advance (MMA) in patients with obstructive sleep apnea (OSA) [13]. The study evaluated the efficiency of virtual surgery planning (VSP) in predicting bone interference in sagittal osteotomy of the mandible in 100 patients. Using Dolphin software, clockwise rotation of the jaw was found to be the movement most likely to cause interference. The VSP showed high sensitivity (100%) but low specificity (51.6%) in predicting interference [14]. The text describes a minimally invasive surgical technique to perform an intraoral condylectomy using a 3D printed cutting guide [15]. The article reviews the use of antibiotic prophylaxis in orthognathic surgery. The evidence suggests that long-term antibiotics reduce the risk of surgical site infection, although uncertainty remains about preoperative dosing versus short-term therapies [16]. In this systematic review, the stability and complications of dental (TB) and bone (BB) apparatus in surgically assisted rapid maxillary expansion (SARME) were evaluated [17]. A systematic review and meta-analysis of relapses in patients with cleft lip and palate following Le Fort 1 osteotomy analyzed 29 studies with 797 patients [18]. This retrospective study compared three Le Fort 1 osteotomy techniques in nasolabial

soft tissue using 3D cone beam computerized tomography. Conventional, subspinal, and conventional osteotomy with remodeling of the anterior nasal spine were evaluated [19]. This article studies the variation between natural head orientation (NHO) and Frankfort horizontal orientation (FH) in 187 patients undergoing orthognathic surgery using 3D images [20]. This study evaluated the effects of segmented and non-segmented Le Fort I osteotomy on soft nasolabial tissues using CBCT. Both techniques caused significant changes in the nasolabial area (SARME) [21]. This systematic review evaluated the stability and complications of dental apparatus (TB) and bone transmission appliances (BB) in assisted rapid maxillary expansion [22]. This study analyzed the effects of various surgical movements in orthognathic surgery on the upper airway through a three-dimensional analysis. Orthognathic surgery usually increases the size of the upper airways, although with some relapse over time. Bimaxillary surgery had the greatest impact on this increase [23]. Personalization in transmaxillary pterygomaxillary dysjunction, orthognathic surgery technique. Through virtual preoperative planning, the precision of the procedure is improved, and potential complications are reduced. The guide is placed on the maxillary tuberosity and a vertical osteotomy is performed using a piezoelectric saw [24]. This article reviews the use of patient-specific osteosynthesis plate (PSOP) versus conventional plates in orthognathic surgery. Analyzing five studies, no significant differences were found in complications or in patient- and professional-reported outcome measures (PROMs). However, PSOPs are significantly more expensive [25]. This study evaluates the minimally invasive surgical technique called Miniscrew Assisted Rapid Palatal Expansion (MISMARPE). The results show that the technique is effective for significant maxillary expansion at the skeletal, alveolar, and dental levels. It is concluded that MISMARPE is a rapid and low-morbidity solution for maxillary expansion in adults, and recommends larger comparative studies and long-term follow-up [26]. This study evaluated the impact of aesthetic bone genioplasty on upper airway volume (UAV) in 44 patients. Using CT scans before and after surgery, changes in the chin, hyoid position, and UAV were analyzed. More research is needed to evaluate the effectiveness of genioplasty in the treatment of obstructive sleep apnea syndrome (OSAS) [27]. The study validated the "Barcelona Line" (BL) as a crucial reference in orthognathic surgery to determine the aesthetic position of the upper maxilla, defined by the distance from the upper incisor (UI) to the soft tissue plane. Images of Caucasian patients from Spain and Brazil were evaluated by health professionals and non-professionals in aesthetic perception. The study concluded that the BL is a reliable tool for planning maxillary position in orthognathic surgery, with a notable preference for positive UI-BL distances. There were no significant differences by country, medical specialty, or gender of the evaluators [28]. This article evaluates the effectiveness of fat grafting in patients with cleft lip and palate, showing its promise in the closure of palatal fistulas, and in the aesthetic and functional improvement of the lip [29]. This article examines the use of Mimics Scientific software for creating surgical guides and personalized plates in minimally invasive orthognathic surgery. Using computerized tomography or cone beam imaging,

osteotomy projections are segmented and reconstructed, improving model definition and better patient recovery, in addition to being an efficient and low-cost technique [30]. This clinical study established a new standard of three-dimensional cephalometric analysis for evaluating the maxillomandibular sagittal relationship in orthodontics and orthognathic surgery, using 700 cone beam computed tomography (CBCT) scans [31]. The study compared the effectiveness of MISMARPE (Minimally Invasive Surgical and Miniscrew Assisted Rapid Palatal Expansion) and SARPE (Surgical Assisted Rapid Palatal Expansion) for maxillary expansion in adults. Both methods were found to be effective [32].

## Discussion

Bibliometric analysis is a graphic visualization tool that enables researchers and readers to understand the evolution of a specific theme, using analytical methods to evaluate the scientific impact of an investigation, as well as evaluating the influence of individual researchers or groups on a specific theme.

Over time, the topics of interest change, in keeping with the physical and psychosocial needs of the patients. Currently there is a trend in contemporary orthognathic surgery toward studying and implementing new methods of planning and execution of surgical techniques (virtual planning, minimal invasion surgery, airway studies, treatment of SAOS).

According to the analysis of co-authors (Figure 3), we find a close corporate network between the European researchers and the South Americans, within which a multicenter analysis stands out, and through which an anatomical reference of soft tissue was validated and used to define the most aesthetic position of the maxilla in a sagittal plane [28]. The European researchers focused on the orientation of the position of the head in relation to the maxillomandibular complex for planning orthognathic surgery [20], and the changes in the level of soft tissues in the nasolabial unit following a Lefort osteotomy with or without segmentation, using a modified alar cinch suture technique [8,11,19].

It should be mentioned that since there is a single author in our qualitative analysis, we are able to observe a close relationship among various medical terms, as well as the total strength of the link (Figures 4,5), which coincides with a recent bibliometric review of the one hundred most-cited articles in orthognathic surgery over the last 50 years [2].

Dr. Orion Luiz Haas Junior has had 513 citations over the past 4 years, which were found in diverse medical specialty journals, such as: plastic surgery, otorhinolaryngology, imaging, and others, which demonstrate the interdisciplinary work of his publications. Within these publications we find: "Computer-assisted planning in orthognathic surgery: systematic review," [5] with 69 citations; "Stability and surgical complications in segmental Le Fort I osteotomy: systematic review," [7] with 60 citations, and "Alveolar corticotomies for accelerated orthodontics: systematic review," [9] with 47 citations. This indicates that research on orthognathic

surgery is gradually increasing, which could be related to the technological innovation implemented in maxillofacial surgery, among which are highlighted various software programs for surgical planning, intraoral scanners, ultrasonic cutting instruments, the study of changes in the airway following orthognathic surgery, customized osteosynthesis materials, and others.

## Conclusion

The results show a growing trend in the number of articles published on contemporary orthognathic surgery, especially in the last 5 years. In the objective, the central themes and concepts in this strategy have turned out to be especially effective in codifying, revealing that the most frequently cited category was “research methodology,” with 262 associated citations (as shown in figure 5).

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