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Orthofacial Surgery Using Aligners: Narrative Review

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ABSTRACT: A synthesis of the available evidence on the use of clear aligners in orthognathic surgery was conducted with the aim of evaluating their clinical effectiveness, periodontal outcomes, biomechanical predictability, and impact on surgical protocols. A literature search was performed in PubMed, Scopus, and Web of Science for studies published between 2020 and 2025, including randomized clinical trials, systematic reviews, scoping reviews, and observational studies. After applying inclusion and exclusion criteria, six articles were selected for qualitative analysis. The studies, published between 2022 and 2025, comprised one clinical trial, retrospective studies, a comparative study, a systematic review, and a scoping review. Findings suggest that clear aligners provide relevant benefits compared with conventional fixed appliances, including improved periodontal health, enhanced patient comfort, and easier oral hygiene. In early surgery and surgery-first protocols, acceptable skeletal and occlusal outcomes were reported, together with a reduction in preparatory orthodontic time. However, the overall accuracy of tooth movements averaged 63%, showing good predictability in buccal torque and mesial displacement but limitations in molar intrusion, lingual torque, and complex rotations. The reviews highlighted important methodological heterogeneity, a tendency to focus on class III cases with mild crowding, lack of standardized success criteria, and absence of long-term follow-up. In conclusion, clear aligners represent a promising alternative in orthognathic surgery, offering advantages in periodontal health, patient comfort, and integration with digital planning. Nevertheless, the current evidence remains limited, heterogeneous, and of moderate quality, requiring cautious interpretation. Prospective multicenter studies with standardized criteria and extended follow-up are needed to more clearly define their role in surgical orthodontics.

Keywords: orthofacial surgery, orthognathic surgery, clear aligners, orthodontics.

I. INTRODUCTION

Orthognathic or orthofacial surgery is a fundamental procedure in the treatment of severe dentofacial discrepancies that cannot be corrected or camouflaged with conventional orthodontic treatment or in patients who have completed their growth stage. The purpose of this treatment is to restore dentofacial harmony, improve masticatory function and facial aesthetics, and significantly contribute to a positive change in the patient's quality of life. To ensure treatment success, close collaboration between the maxillofacial surgeon and the orthodontist is essential, from diagnosis through planning and execution, in order to achieve both functional and aesthetic outcomes[1].

Traditionally, orthodontic-surgical treatment has been carried out using fixed appliances, which allow tridimensional control of dental movements, either before or after surgery. Currently, multiple digital tools have been developed to facilitate planning and treatment in patients with severe maxillofacial disharmonies, such as cone-beam computed tomography (CBCT), intra- and extraoral scanners, and virtual articulators, among others. In this context, the advent of clear aligners has emerged as a comfortable, efficient, and innovative alternative for presurgical orthodontic treatment, particularly in adult patients, who usually have higher esthetic demands and constitute a large proportion of those undergoing these procedures [2,3].

The use of aligners in orthofacial surgery entails not only a change in the appliances employed but also a shift in the overall management of the patient. Their application allows a more fluent interdisciplinary approach among the specialties involved in treatment, digitally aligning the phases in an organized and coordinated manner. However, the evidence available regarding their use in these treatments is still incipient and characterized by highly variable protocols, making it difficult to establish conclusions regarding predictability, clinical effectiveness, and long-term outcomes.

In this regard, it becomes relevant to conduct an updated review of the available

evidence on the use of aligners in orthofacial surgery, exploring the current literature and synthesizing the main findings and outcomes related to this subject.

II. MATERIALS AND METHODS

Search Strategy

A literature search was conducted in the PubMed, Scopus, and Web of Science databases using the following terms:
("orthognathic surgery" OR "orthofacial surgery" OR "jaw surgery") AND ("clear aligners" OR "invisible aligners" OR "Invisalign") AND ("orthodontics" OR "surgical orthodontics").
The search was complemented by a backward review of the references cited in the selected articles to identify additional relevant literature.

Inclusion and Exclusion Criteria

Primary studies and systematic reviews published between 2020 and 2025, in English or Spanish, with full-text access were included.

The following types of studies were considered:

- Systematic reviews and meta-analyses
- Randomized clinical trials
- Observational studies

The following were excluded:

- Narrative reviews, letters to the editor, and case reports
- In vitro or animal studies
- Articles without full-text availability
- Articles outside the defined time frame

Selection and Data Extraction Process

Three reviewers independently evaluated the titles, abstracts, and full texts according to the established criteria. The following data were extracted from the included articles: year, study design, type of malocclusion and surgery performed, phase of orthodontic treatment, use of aligners, validation methodology, and main findings such as clinical effectiveness, treatment time, complications, or adverse effects.

Article Selection

The literature search yielded a total of 66 articles from the selected databases. After removing 9 duplicates, 57 articles remained for title and abstract screening. Of these, 11 studies were selected for full-text review. Finally, 6 articles met the inclusion and exclusion criteria and were included in this review.

III. RESULTS

After applying the inclusion and exclusion criteria, six articles published between 2022 and 2025 evaluating the use of aligners in combination with orthofacial surgery were selected. These encompassed different methodological designs, including a randomized clinical trial, retrospective observational studies, a comparative study, as well as a systematic review and a scoping review. Collectively, these investigations provide growing evidence regarding the feasibility, clinical benefits, and limitations of using aligners in patients undergoing orthofacial surgery.

With respect to clinical and orthodontic outcomes, Cong et al. (2022) evaluated the presurgical decompensation phase with aligners in a cohort of 20 patients, demonstrating that programmed tooth movements showed a mean accuracy of 63.4%. The most predictable movements were buccal torque and mesial displacements, whereas more complex movements such as molar intrusion and lingual torque showed limitations. This finding suggests that, although aligners can replace fixed appliances in surgical preparation, careful planning of tooth movements is required to maximize clinical effectiveness[4].

Similarly, Zhou et al. (2023) reported the application of an “early-surgery” approach in class III malocclusion patients treated with aligners, achieving surgery after an average of 7.7 months of preparatory orthodontics. In addition to a significant reduction in overall treatment time, the authors reported notable improvements in cephalometric parameters and a satisfactory occlusal finish according to the American Board of Orthodontics standards, supporting the usefulness of aligners in accelerated surgical protocols[5].

Regarding periodontal health and quality of life, the randomized clinical trial by De Leyva et al. (2023) represents a relevant contribution, as it included 28 patients undergoing orthognathic surgery under a surgery-first protocol. The results showed that patients treated with aligners had lower plaque index, less bleeding on probing, and better quality of life indicators on both the OHIP-14 and OQLQ-22 questionnaires compared with patients treated with fixed appliances, without differences in total treatment time[6]. In line with these findings, Gu et al. (2025) retrospectively evaluated 60 patients and confirmed that those treated with aligners experienced better oral, physical, and psychological quality of life in the early postoperative period[7]. These results reinforce the notion that, beyond esthetic benefits, aligners can positively influence patients’ subjective perception of treatment, representing an

added value in adults with higher functional and social demands.

In terms of evidence synthesis, the systematic review by Rosenberg et al. (2023) focused on analyzing facial swelling and occlusal quality outcomes after orthognathic surgery in patients treated with aligners versus fixed appliances. The authors identified four retrospective studies with variable results: some reported a significant reduction in facial swelling during the first postoperative week in patients treated with aligners, while others found no relevant differences. Regarding occlusion, results were also heterogeneous, with some studies reporting comparable outcomes and others favoring fixed appliances[8]. Meanwhile, the scoping review by Chan et al. (2025) gathered 31 studies with a total of 298 participants, covering both orthodontics-first and surgery-first protocols. The review concluded that although aligners have shown satisfactory results in digital planning, treatment times, postoperative stability, and patient quality of life, most studies were retrospective, with methodological heterogeneity and limited standardization of protocols, making it difficult to draw firm conclusions[9].

The findings of the selected studies converge in suggesting that clear aligners represent a valid alternative in orthognathic surgery, offering advantages in esthetics, comfort, hygiene, periodontal health, and quality of life. In addition, potential benefits are observed in reducing treatment time in surgery-first and early-surgery protocols, as well as acceptable accuracy in presurgical decompensation tooth movements. Nevertheless, the available evidence remains incipient and heterogeneous, requiring cautious interpretation and highlighting the need for future prospective multicenter controlled studies to more robustly validate the role of aligners in surgical orthodontic treatment.

IV. DISCUSSION

The incorporation of clear aligner therapy into orthognathic surgery protocols has generated growing interest as an alternative to fixed appliances, traditionally considered the gold standard of treatment. Available evidence shows that the benefits of aligners are not limited to esthetics but also impact periodontal health, surgical efficiency, and biomechanical planning.

In the periodontal and patient experience domains, the findings of De Leyva et al. (2023) suggest that aligners result in less gingival inflammation and improved quality of life compared with fixed appliances. However, these benefits, while consistent with the general orthodontic literature, are supported by a single clinical trial with a small sample size. This raises the question of whether such advantages can be reproduced in larger cohorts and in more complex surgical protocols. Moreover, the absence of long-term follow-up prevents determining whether the observed periodontal improvements are sustained over time or are only transient during the immediate postoperative period[6].

Recent evidence indicates that clear aligners not only play a role in dental alignment but can also be integrated into the planning and execution of orthognathic surgery. Zhou et al. (2024) demonstrated that in Class III patients, early surgery could be performed after an average of 7.7 months of orthodontic preparation with aligners, achieving a mean reduction of 5.57 degrees in the ANB angle and a 7.29 mm improvement in the soft tissue profile, along with clinically acceptable occlusal finishes according to American Board of Orthodontics standards. These findings suggest that the decompensation achieved with aligners is sufficient to allow predictable surgical correction. Nevertheless, case selection was limited to patients with mild to moderate crowding, raising doubts about applicability in more complex malocclusions or extraction cases[5].

Biomechanical limitations described by Cong et al. (2022) reported an average accuracy of only 63% for planned movements. While buccal torque and mesial displacements were relatively predictable, more complex movements such as molar intrusion, lingual torque, and distal rotations showed significant discrepancies. These limitations directly affect surgery, as incomplete decompensation may compromise virtual planning and reduce the precision of programmed surgical movements. Thus, although aligners may provide clinically acceptable outcomes in selected scenarios, they still present biomechanical restrictions that necessitate careful case selection[4].

Results concerning occlusal finishing and postoperative stability remain inconsistent, reflecting one of the main challenges in integrating aligners into orthognathic surgery. Although some clinical studies have demonstrated that aligners can achieve acceptable outcomes according to standardized criteria, the systematic review by Rosenberg et al. (2023) revealed marked heterogeneity: in some cases aligners were comparable to brackets, while in others they performed worse[8]. This lack of uniformity is consistent with the scoping review by Chan et al. (2025), which included 31 studies and 298 patients.

The review highlighted the absence of homogeneous success criteria, a tendency to select favorable cases, and a scarcity of long-term follow-ups. Such methodological shortcomings compromise the ability to generalize findings and limit the validity of conclusions. The lack of robust study designs and more diverse samples creates uncertainty regarding long-term skeletal and occlusal stability, a crucial aspect in orthognathic surgery where predictability and permanence of results determine treatment quality. In this regard, although aligner therapy represents a promising alternative, current data call for caution before recommending its routine use and reinforce the need for prospective research rigorously evaluating both occlusal finishing quality and functional and skeletal stability over time[9].

Another relevant aspect highlighted in the literature is that while clear aligners can facilitate the integration of surgical protocols through digital planning tools, their clinical performance still depends on proper interdisciplinary coordination. Three-dimensional virtual planning and surgical simulation have been shown to predict dentoskeletal and soft tissue changes with greater accuracy, but this advantage only translates into consistent outcomes when there is fluent communication between the orthodontist and the maxillofacial surgeon. In this sense, aligners represent an opportunity to optimize the diagnostic and surgical planning phases, although they continue to face practical limitations related to the immediate fabrication of splints, the need for intraoperative adjustments, and the lack of studies systematically evaluating the relationship between planned digital accuracy and long-term clinical stability.

V. CONCLUSION

The incorporation of clear aligners into orthognathic surgery represents a significant change in the way these treatments are planned and executed. Beyond the esthetic advantage perceived by patients, aligners have demonstrated the potential to be integrated into complex surgical protocols, including early-surgery approaches, without compromising skeletal correction or the achievement of a functionally acceptable occlusion. The possibility of reducing orthodontic preparation time and improving the soft tissue profile at an early stage provides tangible benefits for both the patient and the surgical team.

Nevertheless, it is important to acknowledge that the current evidence remains limited, largely based on studies with small samples, short follow-ups, and a bias toward favorable cases. Certain dental movements, such as molar intrusion, lingual torque, and complex rotations, continue to show lower predictability compared with fixed appliances. This biomechanical limitation has a direct impact on surgery, as incomplete decompensation may compromise the accuracy of virtual planning and, consequently, postoperative stability. Likewise, the absence of long-term follow-ups prevents determining with certainty whether the outcomes achieved with aligners display the same long-term reliability as those obtained with brackets.

In this context, clear aligners should currently be regarded as a promising and complementary alternative in orthognathic surgery, particularly in well-selected cases and digitally planned protocols. To consolidate their role in clinical practice, high-quality, large-scale studies are needed to rigorously evaluate not only immediate outcomes in terms of esthetics and patient comfort, but also the accuracy of skeletal correction, the functional stability of occlusion, and the long-term predictability of surgical results. Only then will it be possible to clearly establish the true place of clear aligners in surgical orthodontics.

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