








Assessing the Pros and Cons of Performing Orthognathic Surgery in Patients Undergoing Orthodontic Aligner Treatment

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ABSTRACT

Objective: Orthodontic aligners have become one of the most requested treatments by patients. This study evaluated maxillofacial surgeons' experience of using orthodontic aligners in preparation for orthognathic surgery.

Methods: A survey using an online platform was used to identify some key points about maxillofacial surgeons' prior experiences with orthodontic aligners in the context of orthognathic surgery. Participants were asked to discuss their experience with orthognathic surgery preparation through orthodontic aligners.

Results: In total, 396 surveys were sent, the sample consisted of 92 respondents. The experience of maxillofacial surgeons on this topic is not very large, some of them (45.65%) have not had contact with orthodontic aligners. Advantages include patient convenience and easy postoperative hygiene, while some disadvantages include inefficient postoperative occlusal stability and intermaxillary block and some difficulties in using elastic bands. A very helpful explanation to solve some problems was highlighted by the surgeons, including a more detailed conference on orthodontic preparation. Maxillary segmentation must be avoided according to the majority of surgeons.

Conclusion: The results of the study indicate that not all cases are suitable for orthognathic surgery prepared with orthodontic aligners. While orthodontic aligners offer advantages such as patient-friendliness and improved hygiene, the lower number of surgeons reporting these benefits compared to the disadvantages underscores challenges related to postoperative occlusal stability and limitations with intermaxillary blocks and elastic band usage.

Keywords: Orthognathic Surgery; Orthodontic Appliances; Surveys and Questionnaires; Humans; Orthognathic Surgical Procedures



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INTRODUCTION

The field of orthognathic surgery planning has witnessed

significant advancements over the past two decades [1]. The transition from traditional plaster surgery to digital planning

has brought about a remarkable evolution [2–4]. The precision of three-dimensional surgical movements has improved substantially [5,6]. As a result, surgeons and patients now have the ability to visualize and achieve facial cosmetic changes that were once considered unattainable [7]. This progress in orthognathic surgery planning has led to faster and more accurate procedures, thereby enhancing safety, efficiency, and reducing complications [8,9]bisagittal split osteotomy, with or without genioplasty. All subjects had to have preoperative (T0.

In recent times, a novel tool, known as orthodontic aligners, has been introduced as an adjunct to orthognathic surgery procedures. However, due to its novelty, many orthodontists and maxillofacial surgeons are not yet familiar with its implementation. Consequently, technical challenges may arise during its utilization. Nevertheless, several studies have reported successful orthodontic aligner usage in preparation for orthognathic surgery, without compromising clinical outcomes [10,11]. Despite these affirmations, concerns remain regarding the potential complications or negative consequences that may arise from improper planning [12].

The number of patients and professionals seeking or considering treatment with orthodontic aligners has significantly increased [13,14]. Therefore, the objective of this study is to conduct a retrospective survey assessing the expertise of maxillofacial surgeons regarding orthodontic aligners. This will facilitate a comprehensive discussion on the feasibility and applicability of utilizing clear aligners in orthognathic surgery, with the goal of achieving enhanced surgical safety and superior outcomes.

Main Points;

- While orthodontic aligners offer advantages such as patient convenience and improved hygiene, not all cases are suitable for orthognathic surgery prepared with aligners.
- The study highlights both the benefits and challenges associated with aligner usage, including postoperative occlusal stability, limitations of intermaxillary blocks, and difficulties in using elastic bands.
- Importantly, our research underscores the need to address these challenges to enhance the effectiveness and outcomes of orthognathic surgery with aligners.

MATERIALS AND METHODS

A study design used an online survey questionnaire consisting of nine single-choice and descriptive questions was designed and implemented on Google Forms (Google, Menlo Park, CA, USA). The appropriateness of the questions was debated between the authors and some ideas from other experienced surgeons. The link to the online questionnaire was then sent via e-mail and smartphone message to a variety of OMS surgeons worldwide, with a brief explanation of the purpose of the study. The e-mail addresses were searched on ResearchGate (www.researchgate.com), a social media of researchers.

The online questionnaire was designed to be rapid, anonymous and non-exhaustive to decrease non-responsiveness. Participants started the survey by clicking on the link provided in the e-mail. The questionnaire was created and was available in three different languages (English, Portuguese and Spanish). The link opened the survey directly, and participants were not required to create an account or enter personal information to complete the survey. The target sample of surgeons was determined by the suspicion of having sufficient knowledge and experience in orthognathic surgery. The questionnaire consisted of four personal questions and five research-specific questions (Table 1). As a form of content validity, a pretest survey was sent to 16 residents and postgraduates.

Statistical Analysis

Fischer exact test was performed with RStudio® (RStudio, GNU GPL) and was considered significant with a 95% confidence interval. Descriptive analytic statistics were performed on most available data. The study met the criteria for exemption according to the institutional review board.

RESULTS

A total of 396 online questionnaires were sent, 277 to Brazilian and 119 to worldwide surgeons. A total of 92 responses were collected during a 2-month period. Respondents were 76 male (82.61%) and 16 female (17.39%) maxillofacial surgeons. The majority was in the 31 to 40 age range (36.96%) followed by 41 to 50 (36.96%) (Figure 1). The geographic data are shown in Figure 2. Majority of maxillofacial surgeons can be considered as experts, with more than 10 years of experience in orthognathic surgery (Figure 3). Most surgeons (n = 50) have performed at least one orthognathic surgery using orthodontic aligners treatment (54.34%).

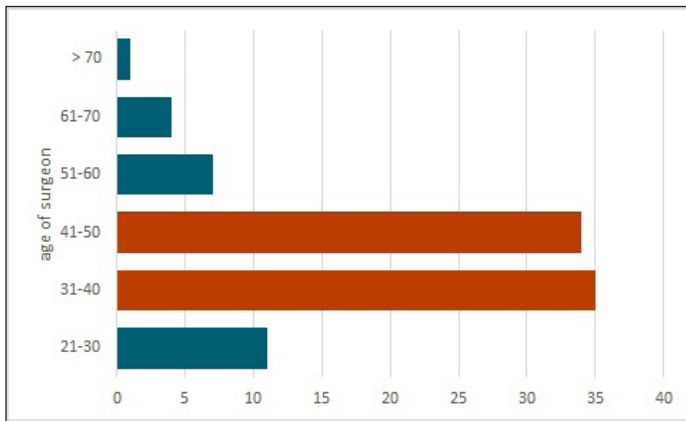


Figure 1. Prevalence of maxillofacial surgeons according to age range

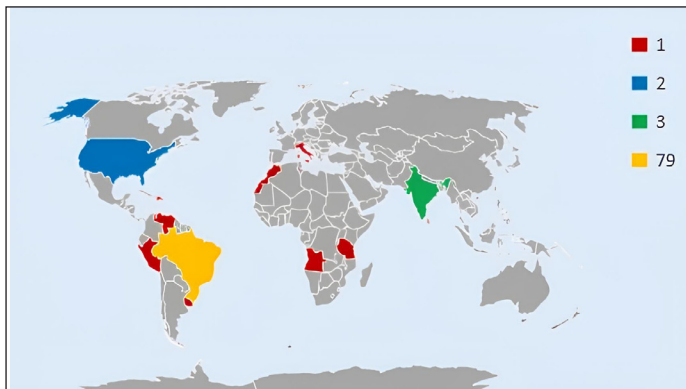


Figure 2. World map of included answers

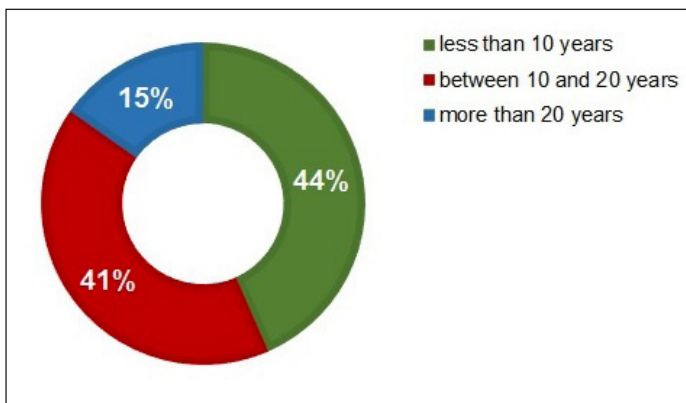


Figure 3. Maxillofacial surgeons' expertise on orthognathic surgery

Responses of these 50 surgeons with positive answers on orthodontic aligners experience were assessed for obstacles, advantages, and disadvantages. It resulted in a low full response rate (12.62%), and this can be explained due to massive number of online surveys performed during COVID-19 pandemics [15]. Surgeons have preferred to use intermaxillary screws (60.87%)

rather than using hooks adapted to conventional orthodontic appliances (32.61%) or buttons/attachments on teeth (38.04%). Some surgeons prefer to use more than a single method (n = 29).

Regarding obstacles, advantages, or disadvantages in performing orthognathic surgery treated with orthodontic aligners, Table 2 summarizes the results. Maxillofacial surgeons treated obstacles as a disadvantage. Some surgeons reported advantages (n = 8) and disadvantages (n = 15) but did not explain them. Some recommendations were given to maxillofacial surgeons in Table 3.

A comparison was made between the number of reported advantages and disadvantages. A Fisher exact test resulted orthodontic aligners had more disadvantages than advantages (p = 0.0504), but this result was not considered statistically significant.

DISCUSSION

The objective of this study was to assess the firsthand experience of maxillofacial surgeons in utilizing orthodontic aligners for orthognathic surgery preparation, with a specific focus on highlighting the advantages and disadvantages associated with this approach. Additionally, the study aimed to explore potential obstacles that may arise during the preoperative, intraoperative, and postoperative phases, along with strategies for effectively managing them.

Orthodontic aligners, also known as clear aligners, emerged in the 1990s and gained significant popularity from 2001 onwards [13]. These aligners have revolutionized the field of orthodontic treatment, leading to a substantial increase in their utilization [16,17]. Orthodontic treatment combined with orthognathic surgery is frequently necessary to effectively manage patients suffering from severe craniofacial deformities. Brackets and wires are conventionally utilized for intraoperative splint stabilization in conventional orthognathic surgery, but such an approach is not applicable for patients undergoing treatment using clear aligners (the Invisalign system. Despite a noticeable upward trend in the number of publications related to orthodontic aligners, there is limited research evaluating the experience of maxillofacial surgeons in utilizing them for orthognathic surgery preparation [14]. Nevertheless, numerous studies have reported various benefits, and both patients and orthodontists have expressed high levels of satisfaction with this treatment modality [14,17] but such an approach is not applicable for patients undergoing

Table 1. Questions of the online questionnaire

Question 1	What is your gender?
Question 2	What is your age range?
Question 3	In which country is your main professional practice based?
Question 4	How many years have you been performing orthognathic surgery?
Question 5	Have you ever operated an orthognathic surgery treated with orthodontic aligners?
Question 6	For the surgery, which devices did you use for intermaxillary fixation? <ul style="list-style-type: none"> • Hooks adapted on conventional orthodontic appliances • Intermaxillary screws • Buttons or attachments on teeth
Question 7	Was there any surgical obstacle?
Question 8	Do you think there is any advantage or disadvantage in performing orthognathic with orthodontic aligner?
Question 9	Any recommendation to other surgeons before performing orthognathic surgery with orthodontic aligners?

Table 2. Advantages and disadvantages in performing orthognathic surgery with orthodontic aligners

Advantages		Disadvantages	
None	1	None	4
Patient friendly	13	Lack of postoperative occlusal stability	16
Better hygiene	9	Intermaxillary block less efficient	14
Occlusal previsibility	4	Difficulty in using elastic bands	12
Faster orthodontic treatment	3	Limitation in performing orthodontically complex cases, i.e. maxillary segmentation	10
		Switch to conventional preoperative appliance	5
		Surgery cost	2
		Lack of digital planning tools	1

Table 3. Pre, trans and postoperative recommendations to maxillofacial surgeons

Precise conference of orthodontic preparation before scheduling surgery (intercuspatation and occlusal stability)	23
Replacement of the aligners with brackets before surgery	8
Case selection	6
The use of elastics in the postoperative period must be accompanied by a lingual retainer to avoid vertical tooth movements	4
Avoidance of maxillary segmentation	3
Care in wearing aligners in postoperative period	2
Use of elastic chain intermaxillary block	1
Wait new studies	1

treatment using clear aligners (the Invisalign system). However, it should be noted that while there is considerable interest and positive feedback, financial constraints have hindered some maxillofacial surgeons from operating on cases prepared with aligners. Consequently, uncertainties persist when orthodontic preparation is required for orthognathic surgery. It is essential for researchers to exercise caution when conducting online surveys, particularly in the context of the COVID-19 pandemic, as the response rates may not meet expectations due to survey fatigue and the overwhelming number of surveys being administered [15]. Therefore, it is advisable to avoid extensive and time-consuming online surveys to ensure meaningful and reliable data collection.

The utilization of orthodontic aligners in preparation for orthognathic surgery has emerged as a contemporary concern, particularly in complex cases. One notable limitation of aligners compared to conventional orthodontic treatment is the absence of dynamic mechanics, resulting in differential stability [13,18,19]. Aligners are primarily effective for tooth alignment, as their name suggests, but may exhibit imprecisions such as lingual displacement of molars, intrusion of lower molars, buccal torque of upper incisors, and rotational movements [19–21]. Maxillofacial surgeons must ensure that appropriate leveling and occlusion are achieved through orthodontic preparation. Currently, there is no consensus in the literature regarding the superior effectiveness or efficacy of orthodontic aligners [10,22,23]. Complications such as inadequate alignment, damage to intermaxillary fixation screws, and incorrect positioning of the occlusal plane may arise.

Despite the clear disadvantages for surgeons, they must acknowledge and embrace the increasing demand for orthodontic aligners from patients seeking enhanced comfort, particularly in terms of periodontal health and overall quality of life [14,17,24]. The proliferation of social media videos and marketing campaigns has significantly contributed to the rising number of patients opting for orthodontic aligner treatment.

The preference for intermaxillary screws over hooks adapted to conventional orthodontic appliances or buttons/attachments on teeth among surgeons indicates a clear inclination towards the use of screws for intermaxillary fixation during orthognathic surgery. This finding suggests that screws offer certain advantages or perceived benefits that make them the preferred choice in most cases. Further exploration of these advantages

and their impact on surgical outcomes would provide valuable insights into the reasons behind this preference. Additionally, the finding that some surgeons opt for multiple methods suggests a personalized approach, where the choice of technique may depend on the specific requirements of each case or surgeon preference.

The reported advantages include patient-friendliness, improved hygiene, occlusal previsibility, and faster orthodontic treatment. These benefits align with the patients' perspective and their desire for more comfortable and convenient treatment options. However, it is important to note that the advantages mentioned were reported by a smaller number of surgeons compared to the disadvantages. The reported disadvantages include a lack of postoperative occlusal stability, less efficiency of intermaxillary blocks, difficulties in using elastic bands, limitations in performing orthodontically complex cases (such as maxillary segmentation), the need to switch to conventional preoperative appliances, and surgery cost. These findings highlight the existing challenges and limitations associated with orthodontic aligner usage in orthognathic surgery.

Collaboration and discussion with orthodontic aligner companies could help address some of the reported issues. The use of elastics plays a critical role in maintaining postoperative stability by leveraging muscle strength. The development of devices that facilitate the proper utilization of elastics could significantly aid in this regard. Similarly, exploring alternatives to conventional orthodontic appliances and intermaxillary blocks, such as custom splints, may prove beneficial [25]. Once these challenges are overcome, the need for transitioning from aligners to conventional appliances in the preoperative phase could be minimized.

Unfortunately, the novelty of orthodontic aligners and their dependence on digital technology have resulted in higher costs for orthognathic surgery. This financial barrier restricts the widespread adoption of orthognathic surgery prepared with orthodontic aligners in certain regions.

Careful case selection is imperative [18,21]. Not all patients are suitable candidates for orthodontic aligners, particularly in the context of orthognathic surgery preparation. The selection and management of orthodontic appliances play a crucial role in achieving positive outcomes [12]. Our survey findings indicate that maxillary segmentation should be approached

cautiously due to the limited efficiency in managing tooth root distalization compared to conventional orthodontics. Both patients and surgeons should be aware about the importance of precise conference of orthodontic preparation before scheduling surgery is emphasized, particularly focusing on intercuspation and occlusal stability.

While a randomized clinical trial would provide a higher level of evidence and more reliable data, it would be limited to the experience of a single surgical team. Online research, on the other hand, offers valuable and up-to-date information from various surgeons on the subject.

Limitations

This survey shares common limitations with other studies of its kind. The questions were not specifically designed to address the broader knowledge on the topic but rather aimed to capture the overall experience of surgeons. The low response rate does not diminish the risk of type 2 error (false negative) and prevents cross-referencing of answers regarding experience, training duration, number of surgeries performed, and the described advantages and obstacles. Future studies may corroborate these findings or shed light on the knowledge gaps surrounding treatment possibilities and functionalities of orthodontic aligners. Furthermore, investigating different brands of orthodontic aligners and assessing the advantages and disadvantages of each is also a topic worth exploring.

CONCLUSION

The results of the present study have shown that respondent surgeons agree that orthognathic surgery prepared with orthodontic aligners is not suitable for all cases such as maxillary segmentation. The preference for intermaxillary screws among surgeons for orthognathic surgery fixation indicates their perceived advantages and benefits. The utilization of multiple methods also suggests a personalized approach based on case-specific requirements and surgeon preferences. The reported advantages of orthodontic aligners, including patient-friendliness, improved hygiene, occlusal previsibility, and faster orthodontic treatment, align with patient expectations for comfort and convenience. However, the smaller number of surgeons reporting advantages compared to disadvantages highlights the existing challenges and limitations associated with aligner usage, such as postoperative occlusal stability, efficiency of intermaxillary blocks, and difficulties with elastic band usage. Addressing these challenges will be essential for enhancing the efficacy and outcomes of orthognathic surgery

with orthodontic aligners.

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