



# Orthodontists' Perceived Satisfaction with Aligner Treatment

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## Abstract

The objective of this study was to assess the perceptions of orthodontists practicing in Morocco and their degrees of satisfaction with aligner treatments. A descriptive cross-sectional study was conducted during the 8<sup>th</sup> annual scientific days of the orthodontist (from 13 to 16 February 2020), among qualified orthodontists from the private and public sectors, practicing in Morocco. General practitioners providing orthodontics were excluded. Data analysis was performed using SPSS software. It was descriptive for all the variables. The qualitative variables were expressed in number and percentage. The main results of this study were that orthodontist's satisfaction with the results obtained by the aligners, in terms of the category of malocclusion, type of treatment and the predictability of orthodontic movements was more or less well. In the general perception of treatments by aligners versus conventional fixed treatments, 77.2% of participants gave a score higher than 5. In conclusion, the aligner technique certainly has advantages, but also has difficulties and limits that are often binding for the practitioner in terms of the quality of the treatment results. Indeed, the long process of making and receiving and the unpredictability of certain movements are among the main factors calling into question the effectiveness, even the efficiency, of these new techniques.

## Subject Areas

Dentistry

## Keywords

Orthodontic Treatment, Satisfaction, Clear Aligners

## 1. Introduction

Orthodontic treatment with clear aligners is a quickly growing sector of ortho-

dontic treatment. [1] The number of adults seeking orthodontic treatment has recently increased significantly, leading to a demand for appliances that are both more aesthetic and comfortable than traditional fixed appliances. [2]

It is commonly reported that aligner treatments seem to be a new development. However, the idea of using aligners to straighten teeth was introduced in 1946 by Kesling. Who designed the “tooth positioning device”, based on the use of a series of thermoplastic splints to gradually achieve improved tooth positions? [3]

In 1997, Align Technology (Santa Clara, California) incorporated modern technologies making good use of Computer Aided Design and Manufacturing (CAD-CAM) as well as three-dimensional acquisition, making the concept of Kesling: an achievable orthodontic treatment. [4] In 2018, Canadian researchers conducted a survey to highlight the factors influencing the satisfaction of patients treated with aligners. 70% of positive responses were reported on the section evaluating invisibility, aesthetics dental, facial aesthetics, comfort and ease of hygiene. [5] These advantages have made this innovative technology an essential component of the orthodontic arsenal.

According to our knowledge, during the past two decades, studies concerning aligners have focused mainly on the description of the system, the biomechanics specific to the aligners and the efficiency in terms of the predictability of dental movements expected. The articles published were mainly case reports and a series of cases, reporting on the rendering of treatment. However, few published studies have recorded the satisfaction of orthodontists with the stages of treatment, the services provided by the laboratories and the quality of the results offered by this technique.

The objective of this study was to assess the perception of orthodontists practicing in Morocco and their degree of satisfaction with aligner treatments.

## 2. Methods

A descriptive cross-sectional study was conducted during the 8<sup>th</sup> annual scientific days of the orthodontist (from 13 to 16 February 2020), among qualified orthodontists from the private and public sectors, practicing in Morocco. General practitioners providing orthodontics were excluded.

The survey support consisted of a questionnaire with both closed-ended, simple yes/no questions, multiple choice questions and some open-ended questions. It also included questions that were answered using a 3-point Likert scale. This questionnaire consisted of three distinct sections:

- The first one, dealt with general information about the practitioner such as gender, the number of years of orthodontic practice, the city of exercise, and basic training in orthodontics.
- The 2<sup>nd</sup> one concerned information on the use of aligners by practitioners such as the training(s) followed on treatments with aligners, the system(s) used and reasons for not using them.

- The last one was focused on the satisfaction of the practitioners with the provision of laboratory services, the duration of chair work compared to conventional treatments, results at the end of treatment compared to conventional treatments and overall satisfaction.

The questionnaires were administered by a single operator to practitioners who verbally agreed to participate in the study. All participants were informed in advance about the purpose of the study, anonymity and confidentiality of the data collected.

Data analysis was performed using SPSS software. It was descriptive for all the variables. The qualitative variables were expressed in number and percentage.

### 3. Results

This study included a total of 70 orthodontists (37 females and 33 males). The distribution of the sample according to the city of practice showed that 44.8% of orthodontists, participating in the study, practiced in Casablanca, 14.3% in Rabat and 10% in Marrakech. 70% of orthodontists had been practicing for more than 10 years, 14.3% between 5 and 10 years and 15.7% for less than 5 years. The distribution of the sample according to basic orthodontic training showed that 67.1% of orthodontists had a national specialty diploma and 31.4% had a university degree.

18.6% of orthodontists surveyed reported not using aligners in their orthodontic practice. The reasons reported were mainly high cost (69.23%), lack of demand (23.07%), lack of experience (53.48%) and limited results (53.48%). 70.2% of orthodontists using aligners had more than 10 years of experience. Regarding the aligner training, 68.1% of orthodontists had received training on aligners. 52.9% of orthodontists used the Invisalign<sup>R</sup> system and 35.7% the ClearAligner<sup>R</sup> system.

For the Satisfaction with laboratory service delivery, the submission stage for aligner treatment, 57.9% of orthodontists used conventional impressions, 24.6% used both types of impressions (Conventional and digital) and 17.5% of orthodontists used digital impressions. 56% of orthodontists using the optical impression were satisfied with it, compared to the conventional impression. 46.8% of practitioners using the conventional impression were satisfied with the recovery mode.

Concerning the development stage of the virtual set-up, the distribution of the sample showed that 41.4% were satisfied with the time required for fingerprint scanning, and 30% were satisfied with the time taken to return changes made to the virtual set-up. For the aligner reception stage, the distribution of the sample showed that 50.9% were satisfied with the delivery time, 36.8% were moderately satisfied and 24.6% were not satisfied.

Our results according to the satisfaction of orthodontists with regard to treatment modalities by aligners (**Table 1**) in comparison to conventional orthodontic treatments, showed that 89.5% reported being satisfied with the dura-

tion of the control sessions, 64.9% were satisfied with the time spent in the chair during attachment fitting sessions and performing interproximal reductions while 59.6% were satisfied with the duration of emergency management.

Regarding the total duration of treatment by aligners, our study showed that 50.9% of orthodontists were moderately satisfied, 42.1% were satisfied and 7% were not.

The orthodontist's satisfaction with the results obtained by the aligners is resumed in **Table 2** and **Table 3**. In terms of type category of malocclusion, the degree of satisfaction of orthodontists was 82.5% for class I with dental crowding,

**Table 1.** Satisfaction of orthodontists with chair time and overall treatment time.

Variables	Satisfied N (%)	Moderately satisfied N (%)	Not satisfied N (%)
Attachment session and interproximal reduction	37 (64.9%)	18 (31.6%)	2 (3.5%)
Control sessions	51 (89.5%)	5 (8.8%)	1 (1.8%)
Emergency management	34 (59.6%)	19 (33.4%)	4 (7%)
Overall duration treatment	24 (42.1%)	29 (50.9%)	4 (7%)

N = Number; (%) = Percentage.

**Table 2.** Satisfaction of orthodontists according to the type of malocclusion and orthodontic treatment.

Variables	Satisfied N (%)	Moderately satisfied N (%)	Not satisfied N (%)
<b>Type of malocclusion:</b>			
Anterior crossbite	18 (31.6%)	32 (56.1%)	7 (12.3%)
Class I with crowding	47 (82.5%)	10 (17.5%)	0 (0%)
Class II	10 (17.6%)	41 (71.9%)	6 (10.5%)
Class III	7 (12.3%)	32 (56.1%)	18 (31.6%)
Endoalveolus	17 (29.8%)	37 (64.9%)	3 (5.3%)
Infraclusion	17 (29.8%)	27 (47.4%)	13 (22.8%)
Overbite	20 (35.1%)	29 (50.9%)	8 (14%)
<b>Type of orthodontic treatment:</b>			
Class II /III cases	9 (15.8%)	40 (70.2%)	8 (14%)
Ortho-periodontal cases	32 (56.1%)	20 (35.1%)	5 (8.9%)
Ortho-prosthetic cases	30 (52.6%)	26 (45.6%)	1 (1.8%)
Ortho-surgical cases	7 (12.3%)	35 (61.4%)	15 (26.3%)
Treatment with extractions	8 (14%)	20 (35.9%)	29 (50.1%)

N = Number; (%) = Percentage.

35.1% for an overbite and 31.6% for the anterior crossbite. (Table 2)

For the choice type of orthodontic treatment, 56.1% of orthodontists reported being satisfied with treating ortho-periodontal cases, 52.6% treating ortho-prosthetic cases and 15.8% treating Class II and Class III orthopedic cases. (Table 2)

The participants were satisfied with the predictability of orthodontic movements: 68.4% for arch expansion, 42.1% for torque and 40.4% for ingression. (Table 3)

Comparing the general perception of aligner treatments versus conventional fixed treatments (Table 4) and using a scale from 0 to 10; 77.2% of participants gave a score higher than 5, and 22.8% assigned a score less than or equal to 5. Our results revealed that 49.1% of orthodontists reported that aligner treatments were cost-effective, 33.3% reported that orthodontic treatment with aligners is a good alternative to conventional treatments with fixed appliances while 31.6% judged that their involvement during treatment with aligners was minimal treatments.

**Table 3.** Satisfaction with the predictability of dental movements.

Variables	Satisfied N (%)	Moderately satisfied N (%)	Not satisfied N (%)
Egression	18 (31.6%)	36 (63.2%)	3 (5.3%)
Expansion	39 (68.4%)	13 (22.6%)	5 (9%)
Ingression	24 (42.1%)	27 (47.4%)	6 (10.5%)
Mesio-distal Translation	18 (31.6%)	34 (59.6%)	5 (8.8%)
Rotation	24 (42.1%)	30 (52.6%)	3 (5.3%)
Tipping	23 (40.4%)	27 (47.4%)	7 (12.3%)
Torque	23 (40.4%)	27 (47.4%)	7 (12.3%)

N = Number; (%) = Percentage.

**Table 4.** General perception of aligner treatments compared to fixed conventional treatments.

Variables	Number	Percentage
<b>Alternative to fixed attachment</b>		
Yes	19	33.3%
NO	38	66.7%
<b>Limited involvement of the orthodontist in treatment</b>		
Yes	18	31.6%
NO	39	68.4%
<b>Profitability</b>		
Yes	28	49.1%
No	29	50.9%

N = Number; (%) = Percentage.

## 4. Discussion

Orthodontics with aligners has established itself in recent decades as orthodontic equipment in its own right, thus arousing the interest of both practitioners and patients. The present study is a descriptive cross-sectional survey whose main objective was to assess the appreciation of orthodontists in terms of satisfaction with aligner treatments, in order to emphasize the strengths and weaknesses of these devices. The main results of this study were that orthodontist's satisfaction with the results obtained by the aligners, in terms of category of malocclusion, type of treatment and the predictability of orthodontic movements was more or less well. In the general perception of treatments by aligners versus conventional fixed treatments, 77.2% of participants gave a score higher than 5. The data collection of this study was carried out at the 8<sup>th</sup> annual Orthodontist Scientific Days, in order to target a large representative sample of qualified orthodontic practitioners throughout Morocco. The anonymity of the questionnaire, its structure, and the freedom to participate in the survey were put in place to obtain results that best reflect the reality of perceptions.

70 orthodontist practitioners participated in the study. 43.2% of them practiced in the city of Casablanca. Our results are consistent with data published in 2017 by the National Council of Dentists, which estimated the existence of more than 4500 dentists in Morocco, and the city of Casablanca has 1700; representing 36% of the total. [6] Concerning the sex ratio, our sample shows a slight predominance of the female gender at 52.9%. This breakthrough alludes to the feminization of dentistry and has been the subject of several controversies. In this context, a study done in Ontario showed that the proportion of women in dentistry is constantly increasing. Indeed, the rate of female employment was 16% in 1991, that percentage rose to 28% in 2005, and in 2010, the majority of students enrolled in dental school were girls. [7] Regarding the number of years of practice, 70% of orthodontists who use aligners have practiced for more than 10 years. The reluctance observed among young practitioners can be interpreted by the recent aspect of the technique and the need for professional ease which is acquired with experience. For our sample, 68.1% of aligner users received training in this regard. Indeed, the technique by aligners considered recent still does not appear in the academic program of the orthodontic specialty. This justifies the use of orthodontists in the training offered by the various providers, in order to improve their therapeutic skills and their ability to succeed in the treatment of different malocclusions. In order to better understand the difficulties of practitioners to adhere to treatments by aligners, we have devoted part of our study to the reasons justifying the unused technique by 24.3% of orthodontists questioned. The high cost (34.61%), lack of experience (26.92%) and lack of patient demand (26.92%) were the main reasons. Our results are similar to those of a retrospective study, conducted in France in 2017, aimed at taking stock of the possibilities and limitations of orthodontic aligners. Questioning the therapeutic performance and fees generated by the service was a barrier to orthodontists

opting for these devices in their daily practice. [8] On the other hand, Alexandra D. Best *et al.* [9] showed that both orthodontists and general dentists are electing to treat a variety of moderate to severe malocclusions with aligners, but there are differences in case confidence, treatment management, and expertise that supports the importance of experience in the management of malocclusions by aligners. According to another study carried out in Italy in 2019, the limited and conditioned quality of the results is the most demotivating factor at 45%. [10]

Dental impressions are an indispensable preliminary tool for any therapeutic project in this case as part of the orthodontic technique by aligners. The quality of the dental impressions submitted to the laboratory depends on the speed with which therapeutic simulations are put online and the availability of the aligners. Indeed, in order to avoid rejection as a result of recording defects, dental impressions must be carefully made, rigorously preserved and documented before being forwarded and then subjected to digitization. In this study, 57.9% of orthodontists responded using conventional impressions. This percentage may be justified by the availability of the necessary equipment and the possibility of subsequent digitization. The optical impression, based on the use of intra-oral scanners, was created in the 1980s. It has the advantage of instant scanning of the patient's data, thus overcoming the various constraints associated with conventional dental impressions. This technique has been a great success in the field of orthodontics, which most of its users are satisfied with, as noted in our study. Francesco Magano *et al.* [11] agree with our results and justify this preference by the fact that there is a learning curve for adopting digital impressions in the dental clinic, and this aspect must be considered with attention. [12] [13] [14] Subjects with a greater affinity for the world of technology and computers (e.g. young orthodontists) will find it very easy to adopt it in their practice. Older clinicians with less experience and passion for technological innovations could find using the devices and related software more complex. [12] [13] [14] In this study, 50.9% were overall satisfied with the time required for scanning and 36.8% of the time taken to process changes made by the practitioner. According to a study done in Taiwan, detailing the different phases of the Invisalign process, it was mentioned that after receiving the impressions, the company's engineers put the 3D simulation online and set up an initial treatment plan in accordance with the instructions of the orthodontist. This first phase takes about 10 to 15 days. [15] Also, on the Align Technology site, the various modifications are displayed within 3 to 5 days. [16] As regards the delivery time of the aligners, 38.6% of the participants reported that they were not satisfied. The manufacture of the aligners and their delivery remains variable depending on the firm concerned, depending on whether the laboratory is available locally or outside the country of practice. On the Invisalign website, it is stipulated that a period of 30 working days is necessary, 15 days for the manufacture of the aligners and 15 days for delivery. Despite the time taken for the processing and delivery of the

aligners, this treatment remains by far a more time-effective treatment than the conventional one. Peter H. Buschang *et al.* in their systematic review revealed that the conventional treatment required significantly ( $P < 0.01$ ) more visits (approximately 4.0), a longer treatment duration (5.5 months), more emergency visits (1.0), greater emergency chair time (7.0 minutes), and greater total chair time (93.4 minutes) than an aligner treatment. [17] Inter-proximal reductions (IPR) are one of the most common modalities in the treatment by aligners. Attachments are also an indispensable tool for retaining aligners and optimizing dental movement. These interventions are indicated beforehand on the 3D simulation while specifying the number, the quantity and the time to perform them. The success of the treatment depends on the quality of their realization and therefore on the rigor that the practitioner devotes to it. In this study, 64.9% of practitioners reported overall satisfaction with the length of time taken for such a procedure. The vast majority of orthodontists polled were satisfied with the overall length of treatment, the length of follow-up sessions and the management of emergencies. The control sessions of the treatments by aligners are less demanding and require less material and time. They are generally devoted to supervising the smooth running of the treatment, evaluating the adaptation, achieving the indicated delayed amelar reductions and delivering the following aligners. [18] In addition, for aligner treatments, emergency visits are less frequent compared to the conventional system. This is due to the fact that there are few auxiliary parts likely to break, but also to the removal during meals, which makes them less prone to fracture. [18] According to a study done in Texas, Buschang *et al.* concluded that conventional orthodontic treatments require more control sessions (about 4.0) and emergency visits (about 1.0), with longer chair time (93.4 minutes) and more time in the chair per sitting (7 minutes) compared to the aligner treatments. [19]

In this study, practitioners were 50.9% satisfied with the overall duration of treatments by aligners. These results are supported by the retrospective studies of Djeu [20] and JiafengGu [21] in which it was reported that aligners require less overall processing time compared to fixed techniques.

Our study showed that the treatment by aligners of Class I malocclusions with crowding was the most satisfactory clinical situation (82.5%). Boyd and Joffe reported the effectiveness of aligners in treatment of dental crowding, which could be resolved by lateral or antero-posterior expansion, interproximal reductions, or even extraction of a mandibular incisor. [22] [23] However, Kravitz found in his clinical trial that the average accuracy of dental movements was around 41%. [24] In the same vein, Align Technology pointed out that 20% to 30% of patients treated by Invisalign need over corrections to achieve the therapeutic objectives. [16] Charalampakis reported in his clinical trial that the rotational movements obtained were significantly less than those planned. [25] The predictability of dental movements is essentially related to tooth type and direction of movement. [26] Despina Koletsi and al revealed in their systematic re-



view and meta-analysis that rotational movements have been demonstrated the highest levels of inaccuracy. [27] According to some reports, [27] canines demonstrate a mean rotational discrepancy between predicted and finally achieved movement of approximately 3.8°. This is important, since inaccurate prediction of tooth movements might be associated with prolonged duration of aligner treatment with an additional need for refinement strategies. Patient burnout and, most likely, increased potential for relapse tendency are further concerns. [28] [29] In the literature, the mean accuracy of tooth movement with aligner was 41%. [30] The most accurate tooth movement was lingual constriction (47.1%) and the least accurate tooth movement was extrusion (29.6%). [30] The mandibular canine was the most difficult tooth to control. Maxillary and mandibular canines achieved approximately one third of the predicted rotation. The accuracy of canine rotation was significantly lower than the rotation of all other teeth, with the exception of the maxillary lateral incisors. At rotational movements greater than 15°, the accuracy for the maxillary canines was significantly reduced. With the exception of canine rotation, no tooth was significantly less accurate in movement. [31]

During the investigation, we tried our best to overcome the difficulties encountered and to avoid bias so as not to alter the value of the results. Nevertheless, we faced some challenges, including:

- the refusal of certain orthodontists to answer the questionnaire,
- the difficulty of recovering certain distributed questionnaires,
- the reduced number of practitioners using aligners in daily practice.

## 5. Conclusion

The main results of this study were that orthodontist's satisfaction with the results obtained by the aligners, in terms of category of malocclusion, type of treatment and the predictability of orthodontic movements was more or less well. In the general perception of treatments by aligners versus conventional fixed treatments, 77.2% of participants gave a score higher than 5. The aligner technique certainly has advantages, but also difficulties and limits that are often binding for the practitioner in terms of the quality of the treatment results. Indeed, the long process of making and receiving and the unpredictability of certain movements are among the main factors calling into question the effectiveness, even the efficiency, of these new techniques. In this context, efforts should be made to perfect these devices, including facilitating the delivery process, thereby reducing the costs generated and adapting the aligners according to each case.

## Conflicts of Interest

The authors declare no conflicts of interest.

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