An investigation of the opinions and preferences of orthodontists in Turkey regarding the use of clear aligners in orthodontic treatment: Original article

Ortodontik tedavide şeffaf plak kullanımına ilişkin Türkiye'deki ortodontistlerin görüş ve tercihlerinin incelenmesi: Orijinal araştırma

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Abstract

Aim: To evaluate orthodontists' perspectives on clear aligner treatment in Turkey.

Methods: A novel web-based survey consisting of 14 questions was developed and sent to 2027 members of the Turkish Orthodontic Society via e-mail to evaluate the reasons for why or why not they prefer clear aligners, their opinions about different brands in the market and their perspective on the future of this treatment modality. The association between demographic data and multiple choice questions was examined using Kruskal Wallis and Mann-Whitney U tests. The association between Likert-type questions and practice characteristics was analyzed using a one-way analysis of variance (ANOVA) and Turkey's post hoc tests.

Results: 62.7% of the 218 respondents currently treat their patients using clear aligners and 76.7% of them prefer Invisalign (Align Technology, California, USA), a clear aligner brand. The main reasons given by orthodontists to use clear aligners were 'not to lag behind in technology' and 'to have prestige in the community'. The majority of participants (83.8%) treat fewer patients with clear aligners than with fixed appliances. 70% of the surveyed orthodontists do not believe that treatment with clear aligners will completely replace treatments with fixed appliances in the near future. 28.6% of the participants stated that they do not intend to use clear aligner treatment in at least the next 1-2 years due to 'low financial income' and 'complexity of clear aligner treatments.

Conclusion: The majority of the surveyed orthodontists currently use clear aligners in their practice, not because they believe clear aligners are more effective or more comfortable than braces or because they are more profitable, but rather to have prestige in the community and not to lag behind in technology. Therefore, it seems that fixed appliance treatment will maintain its place in orthodontic practice as an option for the near future.

Keywords: Methods; orthodontics; orthodontic appliances

Öz

Amaç: Türkiye'deki ortodontistlerin şeffaf plak tedavisine bakış açılarını değerlendirmek.

Yöntemler: Türk Ortodonti Derneği üyelerinin şeffaf plaklar hakkındaki tercihlerini araştırmak, sektördeki farklı markalar hakkındaki görüşlerini ve bu tedavi yönteminin geleceğine bakış açılarını değerlendirmek amacıyla 14 sorudan oluşan bir web tabanlı anket geliştirilmiş ve kendilerine e-posta yoluyla gönderilmiştir.

Bulgular: Ankete katılanların %62,7'si şu anda hastalarını plak kullanarak tedavi ediyor ve %76.7'si 'Invisalign' (Align Technology, California, USA) plak markasını kullanmayı tercih ediyor. Ortodontistlerin plakları kullanmalarının temel nedeni, 'teknolojide geri kalmamak' ve 'toplumda prestij sahibi olmak' idi. Ankete katılan ortodontistlerin çoğu (%83,8) sabit apareylere kıyasla daha az şeffaf plak hastası tedavi ediyor. Ankete katılan ortodontistlerin büyük çoğunluğu (%70), plaklarla tedavinin yakın gelecekte sabit apareylerin yerini tamamen alacağına inanmıyor. Katılımcıların %28,6'sı 'finansal getirisinin düşük olması' ve 'plak tedavilerinin karmaşıklığı' nedeniyle önümüzdeki 1-2 yıl içinde şeffaf plak tedavisini kullanmayı düşünmediklerini belirtmiştir.

Sonuç: Ankete katılan ortodontistlerin çoğu, şeffaf plakları sabit apareylerden daha etkili/rahat olduğuna inandıkları veya daha karlı oldukları için değil, toplum içinde prestij sahibi olmak ve teknolojide geri kalmamak için kullandığını belirtmiştir. Bu nedenle sabit aparey tedavisinin yakın gelecekte bir seçenek olarak ortodonti pratiğindeki yerini koruyacağı düşünülmektedir.

Anahtar Sözcükler: Ortodonti; ortodontik gereçler; yöntemler

Received/*Geliş* : 20.11.2022
Accepted/*Kabul*: 20.12.2022

DOI: 10.21673/anadoluklin.1207700

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INTRODUCTION

Although clear aligners (CA) were first introduced as tooth positioners in 1946, their use has become more common in the last 15 years through new technologies and materials widening the range of tooth movements (1,2). CAs provide an aesthetic smile with higher patient acceptance, facilitate oral hygiene, reduce the number and duration of appointments, require fewer emergency visits, and cause less pain compared to traditional fixed appliances (FA) (3,4).

In recent years, the orthodontic practice has been in transition from treatment with FAs to treatment with Cas, and more people have been seeking this treatment modality around the world (5,6). Although CAs were produced primarily to provide advantages to patients, the selection of appliances is not just the patient's decision. There is still no ideal appliance in orthodontic practice, and the differences in clinical efficacy, related comfort, and possible side effects among available options should be evaluated by both patients and orthodontists before making a choice. Prejudices gained by orthodontists from their own experiences and previous training may lead to providing patients with clear information about the advantages and disadvantages of all available treatment methods (7-11).

The choice between FAs and CAs depends on many factors for orthodontists. The digital technical equipment and the educational base required to administer the CA treatment, along with the lack of high predictability in 3D treatment plans of certain malocclusions are some of these factors concerning orthodontists. Similar to FA treatments, treatment with CAs often includes orthodontic auxiliaries such as inter arch elastics and attachments, and procedures, such as interproximal stripping (12). Clinicians must rely on their own clinical experience, expert opinions, and limited published evidence-based results to perform CAs (13-15). Another issue affecting clinicians' preferences regarding CA treatments in Turkey is that of finances. Since imported CA brands are still the leading companies in this field, the fact that their products are priced in the currency of the importing country is also of critical importance for clinicians wishing to minimize treatment costs. Although CAs provide a shorter chair time and treatment duration, the cost of production, the need for patient cooperation, and the inability to treat some complex malocclusions appear to be major limitations of using CA by orthodontists (16,17). The fact that the current knowledge concerning CAs is based on clinical experience rather than scientific evidence causes the future of CAs and orthodontics to remain at a speculative level (18,19). Considering all these factors, it is critical to identify the affecting factors for orthodontists in leaving the FA *comfort zone* and making the transition to CAs in terms of guiding the future of the orthodontic practice. Determining these factors affecting orthodontists' perspective on this subject will have a significant effect to pave the way for future developments in orthodontic practice. To date, research investigating the perspectives of orthodontists on CAs has been conducted in different countries (20,21).

The purpose of this study was to evaluate the affecting factors why orthodontists in Turkey prefer CAs or not and their perspective on the future of this treatment modality. The Null hypothesis was that orthodontists in Turkey currently prefer conventional treatment methods significantly more than CAs due to various factors such as the current lack of evidence and individual experience with CAs.

MATERIALS AND METHODS

Ethical approval of this study was obtained from the ethical committee of the University of Health Sciences Hamidiye Scientific Research (Date: 09.04.2021, Decision no: 21/295) and the study was conducted according to the Helsinki declaration ethical principles. All participants provided informed consent. On July 11, 2021, a web-based survey was emailed to 2027 members of the Turkish Orthodontic Society. A second email was sent two weeks later as a reminder to increase participation. Google Forms was used as an online surveying software to collect data for this study. A novel questionnaire was created consisting of multiple-choice questions (n:12) and 5-point Likert scale questions (n:11) (Appendix).

The questionnaire consisted of a total of 14 questions, divided into 3 sections. The first section included a brief explanation of the survey's purposes, followed by a consent statement for the participants. The second section included demographic (age, gender, city) and practice-related information. The third section evalu-

ated the main subjects related to the perception of orthodontists to CAs and evaluated the following issues:

- The status of following up-to-date developments and training on CAs by orthodontists
- If the orthodontists prefer to treat their patients using CAs or not, if so, why/why not
- Which CA brands do orthodontists prefer to use
- If they have a CA certificate or not
- Orthodontists' beliefs as to whether CA treatment is as effective and comfortable as treatment with FAs for both them and their patients.
- Orthodontists' perspective on the future of CA treatment.
- If the orthodontists have a 3D scanner in their clinics, if so, which brands do they prefer to use
- Orthodontists' perceptions on CA treatment fees in Turkey.

Statistical analysis

Statistical Package for the Social Sciences package program for Windows version 15.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. Statistical power analysis was used to determine the number of samples at α=0.05, and the power of the test at 90%. Simple descriptive statistics were used to determine frequencies. The association between demographic data (including practice characteristics) and multiple-choice questions were examined by Kruskal Wallis and Mann-Whitney U tests when appropriate. One-way analysis of variance (ANOVA) and Tukey's post hoc tests were performed to analyze the association between Likert-type questions and practice characteristics.

RESULTS

A total of 218 orthodontists responded to all the questions. The majority of respondents were female (64.4%), and there was a nearly equal distribution of respondents across the three age groups. 32.9% of respondents had been in orthodontic practice for 0-3 years. The demographics related to age, gender, and practice (institution and years) are summarized in Table 1. 83.3% of orthodontists follow the current developments in CAs and 65.3% of them currently receive training on CAs. The number of orthodontists who had received training on CAs in the '≥10 years in the practice group was significantly greater than those in the '0-3 years in the practice group ($p<0.05$) (Table 2). The majority of respondents (64.9%) think that the effectiveness of different brands of CAs on the market is not similar. 62.7% of respondents currently treat their patients using CAs and orthodontists in the '0-3 years in practice group prefer treatment with CAs significantly less than other groups ($p<0.05$). (Table 3) 14.7% of respondents either temporarily halted providing this treatment or stopped treating patients with CAs altogether. 82.3% of respondents reported that the main reason for providing CA treatments in their clinical practice was 'not to lag in technology'. As a second reason, 67.1% stated that they believe CAs provide a more comfortable treatment than FAs (Table 4). The majority of orthodontists (76.7%) prefer using the 'Invisalign (Align Technology, California, USA)' CA brand, and 29.8% of them prefer 'Orthero'. In addition, % 27.7 of the respondents think that 'Invisalign (Align Technology, California, USA)' brand will always remain a monopoly in the CAs market. 59.7% of respondents who treat their patients using CAs are certified in this modality. The majority of orthodontists (83.8%) treat fewer patients with CAs than with FAs. 69% of orthodontists who are not currently using CAs in their clinical practice do not plan to use this treatment modality in at least the next 1-2 years and they reported 'low financial income' as the major reason for this situation. Respondents who stopped treatment (either temporarily or permanently), defined 'low efficiency of CAs' as the major reason (46.9%) (Table 5). Nearly half of the orthodontists (45.8%) believe that the use of CAs is not as comfortable for patients as is claimed by the companies. Similarly, 47.8% of respondents believe treating patients with CAs is not as comfortable for clinicians as is claimed by companies. 70.7% of orthodontists do not believe that treatment with CAs will completely replace treatments with FAs in Turkey in the near future. However, 41.5% of respondents agreed with this opinion that this may indeed happen within the next 5-10 years in Turkey. The other responses related to the perceptions of orthodontists about CAs are summarized in Table 4 and Table 5. 60% of respondents have a 3D scanner in their clinics and the majority of them (59.4%) use

Table 1. Demographic data of participants

Characteristics	Responses	Percent
Gender	Female	64.4%
	Male	35.6%
Age	24-30	27.8%
	30-35	32.9%
	Older than 35	39.4%
Years in practice	0-3 years	32.9%
	3-6 years	24.1%
	6-10 years	14.4%
	More than 10 years	28.7%
Institution	Orthodontist in Private Clinic	55.6%
	Orthodontist in Dental Health Hospital	1.9%
	Orthodontic residents in University	25.9%
	Lecturer/ Instructor in University	16.7%

Table 2. The percentages of responses to question 3 and 14 and statistical differences between groups

Years in practice	I am currently receiving training on clear aligner treatments		.....of patients refer to my clinic seeking clear aligners as their orthodontic treatment	
		p value		*p* value
0-3	1.722[bcd]	*0.045**	1.945[e]	*0.009**
3-6	3.530[b]		2.435	
6-10	4.128[c]		2.345	
≥10	3.913[d]		4.212[e]	

*Same superscripts indicate a statistical significance.
*p<0.05 is indicated as statistically significance.
*ANOVA and Post Hoc Tukey tests were performed.

Table 3. The percentages of responses to question 4 and statistical differences between groups

Years in practice	Do you currently treat your patients using any brand of clear aligners?			
	Yes	No	Halted	*p* value
0-3[a]	35.2%	63.4%	1.4%	*0.011**
3-6	17.3%	71.2%	11.5%	
6-10	16.1%	74.2%	9.7%	
≥10[a]	16.1%	79%	4.8%	

*Same superscripts indicate a statistical significance.
*p<0.05 is indicated as statistically significance.
*Kruskall Wallis and Mann Whitney-U tests were performed.

the iTero (Align Technology, California, USA) brand. 56% of respondents stated that 0-10% of their patients refer to their clinic seeking CAs for their treatment. Patients request CA treatment from orthodontists in the '≥10 years in practice group more than those in the '0-3 years in practice group (p<0.05).

DISCUSSION AND CONCLUSION

The current study investigated the factors that influence whether or not orthodontists prefer CAs and their outlook on the future of this treatment modality. The majority of practitioners in the 0-3 years group have consisted of orthodontic residents. While it was expected that younger clinicians would be more interested in using CAs, our results presented that they prefer receiving less training on CAs and prefer this treatment method less than their older counterparts. They also find the cost of CA treatments for patients higher than their older counterparts. In contrast, Hussain et al. reported that the youngest generation is more likely to use the latest technology in their practice (20).

Table 4. Responses related to the beliefs of orthodontists' on CA treatment

Characteristics	Responses				
	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I think that effectiveness of different CA brands in the market is similar	26.7%	38.2%	14.7%	16.1%	4.1%
I believe that the use of CAs is as comfortable for patients as it is claimed by the companies	5.1%	17.5%	23%	43.3%	11.1%
I believe treating patients with CAs is as comfortable for clinicians as it is claimed by companies	4.1%	21.7%	21.7%	44.7%	7.8%
I believe that treatment with CAs will completely replace treatments with fixed appliances in --- in the near future	13.8%	45.6%	16.1%	20.7%	3.7%
I believe that treatment with CAs is more efficient than treatment with fixed appliances	14.7%	45.2%	27.2%	8.8%	4.1%
I believe it is hard to learn administering CA treatment	12.9%	47%	17.1%	18.4%	4.6%
I think that 'Invisalign' brand will always remain a monopoly in the CAs market	13.8%	39.2%	19.4%	24%	3.7%
I think the cost of treatment with CAs is too high for patients in -----	0.9%	3.7%	7.4%	45.6%	42.4%
I believe that administering CA treatment will become simpler for orthodontists in the near future.	0.5%	2.8%	12.4%	60.4%	24%

CA: Clear Aligner

Although several different CA systems are currently available in orthodontic practice, consistent differences can be observed between different brands (16,22). The fact that 76% of the participants preferred a particular brand (Invisalign; Align Technology, California, USA) for CA treatments supports their thoughts that they do not find the various CA brands in the market equally effective. It is important to keep in mind that many factors influence the success of tooth movement with CAs, including the shape and location of the attachment, the material and thickness of the aligner, the amount of activation in each aligner, and the techniques used to manufacture the aligners (23). The Invisalign (Align Technology, California, USA) manufacturers claim that they can provide more effective tooth movement by moving teeth 50% faster and 75% more predictability in movement by using a specifically engineered material with confidential content, 'SmartTrack™' (24). It may be a reason why one-third of the respondents believe that the Invisalign (Align Technology, California, USA) brand will always remain a monopoly in the CA market.

The majority of participants had the view that CA treatments are not as simple as they are claimed to be. This idea may be due to some of the requirements of this treatment modality, such as an initial bonding procedure similar to FA treatments and pre-aligner treatments in certain cases. Orthodontists have to gain experience in determining the proper sequence of tooth movements, design and placement of dental attachments, and prescribing over-correction for difficult tooth movements to increase predictability in CA treatment and achieve better treatment outcomes (25, 26). In addition, refinement, adjustment at each appointment, and rebooting are all parts of this modality, and it all depends on the skill of the orthodontist as with any treatment with FAs (27). The majority of the participants believe that using CAs will become easier

Table 5. Responses related to the perspectives of orthodontists on CA treatment

Characteristics	Responses	
Do you currently treat your patients using CAs?	Yes	71.4%
	No	22.6%
	Temporarily halted / Stopped altogether	6%
I prefer treatment using CAs because..	It brings prestige	40.5%
	It brings more financial income	12.7%
	My patients demand CAs more	46.2%
	Not to lag behind in technology	82.3%
	CAs are more effective than fixed appliances	13.3%
	Treatment using CAs are more comfortable than fixed appliances	67.1%
	CAs are more hygenic than fixed appliances	0.6%
	Not to refuse patients who request CAs	0.6%
I do not prefer treatment using CAs because..	It brings low financial income	48.7%
	Lack of digital knowledge concerning CAs	13.7%
	Pre-aligner treatments	48.7%
	Fixed appliances will survive	30.8%
	Low predictability of CAs	38.5%
I temporarily halted providing this treatment / stopped treating patients with CAs altogether because...	CA treatment brings low financial income	28.1%
	CAs are less effective than fixed appliances	46.9%
	Treatment using CAs is less comfortable than fixed appliances for orthodontists	28.1%
	Treatment using CAs is less comfortable than fixed appliances for patients	15.6%
	I have no patients who request CAs	28.1%
I do not intend to start any CA treatment within .... years.	1-2 years	69%
	2-5 years	25.9%
	More than 5 years	5.2%
Which CA brand do you prefer to use?	Invisalign	76.7%
	Orthero	30.2%
	Clearcorrect	9.5%
	Orthomagic	3.2%
	Fabricating in my clinic	6.3%
	Fabricating somewhere boutique	12.7%
Do you have a CA certificate?	Yes	59.7%
	No	40.3%
I am currently treating .... patients using CAs compared to fixed appliances	More	6.9%
	Almost equal	7.9%
	Fewer	83.8%
	Only CA	1.4%

CA: Clear Aligner

in the near future with detailed expert support in the treatment planning process. Concordantly, the number of companies providing treatment planning support is increasing gradually in our country. However, a study demonstrated that the majority of the providers did not feel confident in using 'Invisalign; (Align Technology, California, USA)' following certification and further need support in the planning process (28).

The 'low predictability in CA treatments' seems like a major reason that deters a significant portion of orthodontists from using CAs. Charalampakis et al. superimposed predicted and achieved models over the initial models of patients treated with CAs and stated that the achieved rotations and vertical movements were significantly different than predicted (18). Many subjects who begin CA treatment have been reported to deviate from the programmed progression of CAs and require reevaluation, midcourse correction, and/or use of FAs to achieve treatment goals (16). In addition, Izhar et al. reported that software models do not accurately reflect the patient's final occlusion at the end of active treatment (28).

Although one-third of the participants in our study stated that they do not intend to use CA treatments

for at least 1-2 years, a similar study reported that 69% of the 129 participants who do not currently use CA treatments in their practice are willing to use them in the future (29). Interestingly, the majority of participants stated that only 0-10% of patients refer to their clinics seeking CAs as their orthodontic treatment. The cost of treatment was reported as an important aspect of choosing a specific appliance option, and it was rated the most significant barrier to receiving dental services (30). The evidence suggests that patients may be willing to pay more money for appliances they deem more esthetic and being of the higher economic class was associated with choosing CAs, while being of the lower economic class was associated with choosing FAs (11,31) One study showed that patients who used CA had a significantly higher income than those treated with fixed appliances (29). In the current study, although the majority of respondents declared that they achieve a lower profit margin from CA treatments than FAs; they still prefer this treatment modality to have prestige in the community via treating patients with high economic status. On the other hand, one-third of respondents do not prefer CA treatments due to the same financial reasons. While the profit gap between CAs and FAs in the USA and European countries is much less, this gap is quite wide in our country due to the dollar exchange rate. Although the discount rates of CAs increase in direct proportion to the number of patients treated with the help of several titles (gold, platinum member, etc.) promised by the companies, it is obvious that CAs will not be a more profitable choice for orthodontists in the near future. We think that financial issues are quite distinctive factors, especially for countries in the Middle East; hence CAs may remain as a treatment method for only a 'certain patient audience', at least for a certain period in these countries.

Due to the 'low efficiency of CAs', some of the participants stopped providing CA treatment temporarily or permanently. This issue - its apparent lack of efficiency while treating certain malocclusions - is known as one of the main limitations of CA treatment. Various types of tooth movements including buccolingual inclination (torque), interocclusal sagittal changes, overjet, closure of extraction spaces, occlusal contacts, and expansion have been argued to be less efficient with CAs than with traditional FAs (32). CA has been reported to be a suitable alternative for mild to moderate malocclusions in non-growing patients that do not require extraction but still do not provide the same efficacy as FAs for the aforementioned orthodontic movement types (33,34). In addition, patient adherence is also essential for the success of CAs; nonadherence can result in poor outcomes, and this may affect the efficiency of the appliance (9). In a recent study, it was reported that 8% of the participants halted using CAs after a certain time of using them. In consistent with the current study, 45% of orthodontists not using CAs considered the outcomes with this type of treatment limited compared to conventional FAs. In the same study, 8% of the orthodontists reported having used CA only in the past and having no further intention to consider CA as an orthodontic treatment option in their practice (21).

The vast majority of participants currently treat more patients with FAs than they treat with CAs. Considering that all orthodontists are technically trained in the use of FAs and already have prior knowledge about this treatment method, it is obvious to think that greater familiarity and confidence in the use of these devices make this option the most preferred and perhaps most recommended by them (11). In addition, since there are currently many FA brand alternatives in Turkey, the cost of FA treatments is much lower than the cost of treatment with CAs. Consistent with our study, it has been reported in a study that the major part of orthodontists reported not using CA because of the limited orthodontic final treatment outcomes, the higher price in comparison to traditional fixed appliances, or the having less personal experience (21).

Nearly half of the participants do not believe that the use of CAs is as comfortable for both patients and orthodontists as it is claimed by the companies; this belief can be a critical barrier for orthodontists to recommend CAs to their patients. Evidence suggests that orthodontists consider factors related to the results and clinical performance of the appliance rather than factors related to comfort and quality of life during treatment while recommending appliances. Vasquez et al. reported that after the advantages and disadvantages of each treatment option were explained in detail, there was a tendency among patients of preferring FAs

to CAs. Authors have also demonstrated that patients could sacrifice their aesthetic requirements for obtaining better results (11). Current evidence once again demonstrates how important it is to examine the orthodontists' perspectives on CA treatment. One-third of participants believe that treatment with CAs will completely replace treatments with traditional FAs in Turkey in the near future. In a recent study conducted in the U.S. and Canada, half of the 480 participants (50.2%) stated that clear aligners and conventional braces will have an equal share of the orthodontic consumer market in the future and 25% of them stated conventional orthodontic treatment will always have the greater share of the orthodontic consumer market (20).

Although patients are always interested in trend treatment modalities, the long-term acceptability of CAs by patients in terms of their effectiveness, ease of use, and treatment fee cannot yet be precisely predicted. Moreover, CAs have not yet been fully studied, and their attractive features are still controversial. In addition, retention and stability studies regarding CAs remain limited in the literature. Therefore, the idea that FAs could be completely replaced with CAs may not be an accurate forecast for the near future.

As a limitation, the response rate was 10.75%. However, the respondents participated from 30 different cities in 7 different regions in Turkey. We thought that this diversity would reflect the general point of view of orthodontists in Turkey.

As a result, the Null hypothesis of this study was accepted. As we look toward the future of orthodontics, it is possible to see a revolutionary, transformational change through CAs. Hence, to practice clinically sound, evidence-based orthodontics, well-designed scientific research is strictly needed. Although conducting this study in a specific region seems as a limitation of the study, we believe that each progressive study (especially surveys testing the perception of orthodontists and patients to CAs) to be done in the field of clears is needed and will contribute to our field in this transformation process when conducted worldwide. In addition, with the contribution of similar studies, many orthodontists can decide whether it is worth stepping out of their comfort zone of fixed appliances or not. We hope that this study will be able to give the lead to similar studies worldwide.

For orthodontists, CA treatment preference depends on many constantly changing and developing factors. However, as shown in recent conditions, it is obvious that CAs will not be the first choice for a significant number of orthodontists unless their price is reduced and their administration becomes simpler. In addition, as a specialist, the orthodontist should understand that a certain type of appliance can be an alternative for some cases and not others.

Acknowledgements

Special thanks to Alan Newson for the professional language editing.

Conflict-of-interest and financial disclosure

The authors declares that they have no conflict of interest to disclose. The authors also declare that they did not receive any financial support for the study

REFERENCES

1. Hennessy J, Al-Awadhi EA. Clear aligners generations and orthodontic tooth movement. J Orthod. 2016;43(1):68-76.
2. Kesling HD. The philosophy of tooth positioning appliance. Am J Orthod. 1945;31:297–304.
3. Zheng M, Liu R, Ni Z, Yu Z. Efficiency, effectiveness and treatment stability of clear aligners: A systematic review and meta-analysis. Orthod Craniofac Res. 2017;20(3):127-133.
4. Fujiyama K, Honjo T, Suzuki M, Matsuoka S, Deguchi T. Analysis of pain level in cases treated with Invisalign aligner: comparison with fixed edgewise appliance therapy. Prog Orthod. 2014;15(1):64.
5. Bowman SJ. Improving the predictability of clear aligners. Semin Orthod. 2017;23:65-75.
6. Johal A, Bondemark L. Clear aligner orthodontic treatment: Angle Society of Europe consensus viewpoint. J Orthod. 2021;48(3):300-4.
7. Papadimitriou A, Mousoulea S, Gkantidis N, Kloukos D. Clinical effectiveness of Invisalign® orthodontic treatment: a systematic review. Prog Orthod. 2018;19(1):37.
8. Reicheneder CA, Baumert U, Gedrange T, Proff P, Faltermeier A, Muessig D. Frictional properties of aesthetic brackets. Eur J Orthod. 2007;29(4):359-65.
9. White DW, Julien KC, Jacob H, Campbell PM, Buschang

PH. Discomfort associated with Invisalign and traditional brackets: A randomized, prospective trial. Angle Orthod. 2017;87(6):801-8.
10. Ata-Ali F, Ata-Ali J, Ferrer-Molina M, Cobo T, De Carlos F, Cobo J. Adverse effects of lingual and buccal orthodontic techniques: A systematic review and meta-analysis. Am J Orthod Dentofacial Orthop. 2016;149(6):820-9.
11. Marañón-Vásquez GA, Barreto LSDC, Pithon MM, et al. Reasons influencing the preferences of prospective patients and orthodontists for different orthodontic appliances. Korean J Orthod. 2021;51(2):115-25.
12. Rossini G, Parrini S, Castroflorio T, Deregibus A, Debernardi CL. Efficacy of clear aligners in controlling orthodontic tooth movement: a systematic review. Angle Orthod. 2015;85(5):881-9.
13. Barcoma E, Shroff B, Best AM, Shoff MC, Lindauer SJ. Interproximal reduction of teeth: differences in perspective between orthodontists and dentists. Angle Orthod. 2015;85(5):820-5.
14. Lagravère MO, Flores-Mir C. The treatment effects of Invisalign orthodontic aligners: a systematic review. J Am Dent Assoc. 2005;136(12):1724-9.
15. Javidi H, Graham E. Clear aligners for orthodontic treatment?. Evid Based Dent. 2015;16(4):111.
16. Ponitz RJ. Invisible retainers. Am J Orthod. 1971;59(3):266-72.
17. Charalampakis O, Iliadi A, Ueno H, Oliver DR, Kim KB. Accuracy of clear aligners: A retrospective study of patients who needed refinement. Am J Orthod Dentofacial Orthop. 2018;154(1):47-54.
18. Kravitz ND, Kusnoto B, BeGole E, Obrez A, Agran B. How well does Invisalign work? A prospective clinical study evaluating the efficacy of tooth movement with Invisalign. Am J Orthod Dentofacial Orthop. 2009;135(1):27-35.
19. Jindal P, Juneja M, Siena FL, Bajaj D, Breedon P. Mechanical and geometric properties of thermoformed and 3D printed clear dental aligners. Am J Orthod Dentofacial Orthop. 2019;156(5):694-701.
20. Hussain SR, Jiang SS, Bosio JA. Generational perspectives of orthodontists in the U.S. and Canada: A survey study. Am J Orthod Dentofacial Orthop. 2022;162(6):824-8.
21. d'Apuzzo F, Perillo L, Carrico CK, et al. Clear aligner treatment: different perspectives between orthodontists and general dentists. Prog Orthod. 2019;20(1):10.
22. Tepedino M, Paoloni V, Cozza P, Chimenti C. Movement of anterior teeth using clear aligners: a three-dimensional, retrospective evaluation. Prog Orthod. 2018;19(1):9.
23. SmartTrack Aligner Material. Available from: http://provider. invisalign.com/smarttrack. Accessed on 10 May 2016.
24. Grünheid T, Loh C, Larson BE. How accurate is Invisalign in nonextraction cases? Are predicted tooth positions achieved?. Angle Orthod. 2017;87(6):809-15.
25. Boyd RL. Esthetic orthodontic treatment using the invisalign appliance for moderate to complex malocclusions. J Dent Educ. 2008;72(8):948-67.
26. Mehta S, Mehta F. Aligners: The rapidly growing trend in orthodontics around the world. Indian J Basic Appl Med Res. 2014;402-9.
27. Best AD, Shroff B, Carrico CK, Lindauer SJ. Treatment management between orthodontists and general practitioners performing clear aligner therapy. Angle Orthod. 2017;87(3):432-9.
28. Izhar A, Singh G, Goyal V, Singh R, Gupta N, Pahuja P. Comparative Assessment of Clinical and Predicted Treatment Outcomes of Clear Aligner Treatment: An in Vivo Study. Turk J Orthod. 2019;32(4):229-35.
29. Mueller CD, Schur CL, Paramore LC. Access to dental care in the United States. J Am Dent Assoc. 1998;129(4):229-35.
30. Rosvall MD, Fields HW, Ziuchkovski J, Rosenstiel SF, Johnston WM. Attractiveness, acceptability, and value of orthodontic appliances. Am J Orthod Dentofacial Orthop. 2009;135(3):276.e1-277.
31. Miller KB, McGorray SP, Womack R, et al. A comparison of treatment impacts between Invisalign aligner and fixed appliance therapy during the first week of treatment. Am J Orthod Dentofacial Orthop. 2007;131(3):302.e1-302.e3029.
32. Robertson L, Kaur H, Fagundes NCF, Romanyk D, Major P, Flores Mir C. Effectiveness of clear aligner therapy for orthodontic treatment: A systematic review. Orthod Craniofac Res. 2020;23(2):133-42.
33. Pavoni C, Lione R, Laganà G, Cozza P. Self-ligating versus Invisalign: analysis of dento-alveolar effects. Ann Stomatol (Roma). 2011;2(1-2):23-7.
34. Hansen V, Liu SS, Schrader SM, Dean JA, Stewart KT. Personality traits as a potential predictor of willingness to undergo various orthodontic treatments. Angle Orthod. 2013;83(5):899-905.