Original Article

HEALTH SCIENCES
MEDICINE

DOI: 10.32322/jhsm.1727206
J Health Sci Med. 2025;8(5):775-786

Clinical preferences and practice patterns of orthodontists in Turkiye regarding maxillary molar distalization

Samet Özden, Fırat Oğuz
Department of Orthodontics, Faculty of Dentistry, İnönü University, Malatya, Turkiye

Cite this article as: Özden S, Oğuz F. Clinical preferences and practice patterns of orthodontists in Turkiye regarding maxillary molar distalization. *J Health Sci Med.* 2025;8(5):775-786.

Received: 03.07.2025 ◆ **Accepted**: 24.07.2025 ◆ **Published**: 16.09.2025

ABSTRACT

Aims: The aim of this study was to evaluate the clinical approaches of orthodontists practicing in Turkiye regarding the distalization of maxillary first molars, as well as the factors influencing their treatment preferences.

Methods: This descriptive and cross-sectional survey study included responses from 132 orthodontists who are members of the Turkish Orthodontic Society. The questionnaire, delivered via Google Forms, comprised 37 items covering demographic data, distalization techniques, the use of clear aligners, and retention protocols. Data were analyzed using SPSS version 22.0. Relationships between variables were assessed using the Chi-square test, supported by Monte Carlo simulation where appropriate. A significance level of $p<0.05$ was considered. Ethical approval for this survey-based study was obtained from the İnönü University Scientific Researches and Publication Ethics Committee (Date: 24.09.2024, Decision No: 2024/6452).

Results: All participants reported utilizing maxillary molar distalization in their clinical practice. A total of 84.8% preferred skeletal anchorage-supported intraoral systems, and 62.9% reported placing miniscrews in the infrazygomatic crest region. According to the respondents, distalization was most frequently performed in adolescent patients (78.0%). In class II camouflage cases, 63.6% of orthodontists indicated a preference for premolar extraction. Clear aligner-based distalization was reported by 67.4% of participants, with Invisalign (Align Technology Inc., San Jose, CA, USA) being the most commonly used brand (56.8%) in this subgroup. The average duration of distalization was reported to be between 6 and 9 months by 43.9% of respondents. The most frequently encountered complication was miniscrew loosening (71.2%). In the post-treatment retention phase, 72.0% of clinicians reported using a combination of Essix and lingual retainers.

Conclusion: Maxillary molar distalization is widely employed among orthodontists in Turkiye, with notable variability in techniques and materials used based on clinician preference. These findings highlight the importance of individualized treatment planning and reflect the diversity in contemporary clinical practice.

Keywords: Distalization, survey, skeletal anchorage, orthodontic treatment, clear aligner

INTRODUCTION

According to Angle's classification, class II malocclusion is defined as a dental discrepancy in which the entire mandibular dentition is positioned more distally than normal, resulting in a misalignment between the dental arches.[1] The prevalence of class II malocclusion varies depending on ethnicity, environmental influences, and diagnostic criteria, with a global prevalence estimated at approximately 20%, and reports indicating rates as high as 40% in the 12-17 age group in Turkiye.[2,3] Due to this high prevalence, the management of class II malocclusion holds significant clinical importance, and various treatment modalities-including functional appliances, orthodontic camouflage, and orthognathic surgery-have been developed.[4]

Orthodontic camouflage aims to achieve acceptable occlusion and facial aesthetics without skeletal modification.[5] This treatment can be executed with or without tooth extraction. In non-extraction camouflage approaches, maxillary molar distalization is often employed to create the necessary space.[6]

Maxillary molar distalization is considered a viable non-extraction treatment option in mild to moderate sagittal discrepancies.[7] While traditional intraoral appliances eliminate the need for patient compliance associated with extraoral devices, they are often accompanied by undesirable anchorage loss.[8] To overcome this, temporary anchorage devices (TADs) have been introduced to provide resistance against reactive forces, minimizing anchorage loss during distalization.[5,9] These TADs can be placed in interradicular alveolar areas of the buccal or palatal regions or in extraradicular sites such as the infrazygomatic crest, enabling three-dimensional tooth movement with minimal anchorage loss.[5]

In addition to conventional methods, increasing aesthetic expectations and demand for patient comfort in recent

Corresponding Author: Samet Özden, samet.ozden@inonu.edu.tr

years have led to the widespread adoption of clear aligners as an alternative to labial brackets.[10] Clear aligners offer an effective solution, particularly in cases with mild to moderate crowding.[11,12] Beyond anterior alignment, aligners have also demonstrated the ability to achieve distalization of posterior teeth. Notably, Simon et al.[13] reported high success rates in upper molar distalization using clear aligner therapy (CAT).

Maintaining treatment outcomes over the long term is critical in both fixed appliance and aligner-based orthodontic treatments. As it is well-known that teeth tend to relapse following active treatment, retention protocols are necessary to preserve the achieved aesthetic and functional tooth positions.[14] However, there is no consensus among orthodontists regarding the optimal retention duration or method, resulting in varied clinical practices. Commonly used retention strategies include removable retainers and fixed lingual retainers.[15]

Given the wide variation in distalization methods, aligner protocols, and retention strategies observed in clinical orthodontic practice, there is a clear need for comprehensive, data-driven assessments of current treatment trends. To date, no previous study has systematically examined the clinical preferences of orthodontists regarding upper molar distalization within a national sample. This study fills a critical gap in the literature by providing the first large-scale, survey-based evaluation of real-world distalization practices among orthodontists in Turkiye. Its strength lies in its broad participant base, detailed assessment of both conventional and contemporary treatment approaches-including skeletal anchorage systems and CAT-and its analysis of how clinical decisions are shaped by demographic and institutional factors.

In this context, the aim of our study was to evaluate the clinical approaches of orthodontists in Turkiye regarding maxillary molar distalization, with a particular focus on appliance selection, skeletal anchorage preferences, clear aligner usage, and retention protocols.

METHODS

Ethics Committee Approval

This study was approved by the İnönü University Scientific Researches and Publication Ethics Committee (Date: 24.09.2024, Decision No: 2024/6452). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Design of the Study

This study is a descriptive, cross-sectional survey research based on responses collected from licensed orthodontists in Turkiye.

Participants and Sample Size

To ensure the collection of diverse and representative data, the study population was selected from among actively practicing orthodontists in Turkiye. A total of 132 orthodontists, all registered members of the Turkish Orthodontic Society, were contacted via email. The email correspondence included a detailed cover letter explaining the objectives of the study, accompanied by a link to the online survey form. The targeted sample encompassed orthodontists working across a variety of institutional settings, including Public Oral and Dental Health Centers, University Hospitals, and Private Clinics or Polyclinics.

Data Collection

Before distribution, the questionnaire was reviewed and approved by experts from the Turkish Orthodontic Society to ensure its clarity, relevance, and content validity. The questionnaire was created and distributed via Google Forms and consisted of 37 questions designed to assess participants' demographic characteristics and clinical preferences. It was structured under three main sections: demographic information (Table 1), distalization approaches (Table 2), and clear aligner-based distalization and retention protocols (Table 3).

Table 2 presents the questions aimed at evaluating the participants' clinical preferences regarding upper molar distalization. This section investigates factors such as the most commonly used distalization appliances, reasons for appliance selection, target patient groups, and the average duration of treatment. In addition, the frequency of miniscrew use, preferred insertion sites, and experiences with miniscrew failures are also addressed under this category.

Table 3 includes questions evaluating orthodontists' approaches to distalization treatment using clear aligners and the retention protocols implemented after treatment. This section explores the prevalence of clear aligner usage, preferred brands, clinical application strategies, as well as the types and duration of retention appliances.

Statistical Analysis

The collected data were analyzed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequency, percentage, mean, median, and standard deviation, were calculated. Associations between categorical variables with two or more groups were evaluated using the Chi-square test. Although subgroup analyses were conducted, multivariate methods such as logistic regression were not employed, as the primary

Table 1. Questions regarding the demographic characteristics of the participants

Q1-What is your gender?	Q2-What is your age?	Q3-What type of institution do you work at?	Q4-What is your title?	Q5-How many years have you been practicing in the profession?
Male	20-25	Public oral and dental health center	Research assistant	0-3 years
	26-30	University hospital	Specialist dentist	3-6 years
	31-35		Lecturer	6-10 years
Female	36-40	Private clinic/polyclinic	Assistant professor	
			Associate professor	Over 10 years
	Over 40	Other	Professor	

Table 2. Treatment approaches of maxillary molar distalization	
Q6-Do you perform maxillary molar distalization in your clinical practice?	Yes
	No
Q7-Which radiographic methods do you commonly use when planning distalization?	Panoramic radiograph
	Cephalometric radiograph
	CBCT
	Digital setup or 3D modeling
Q8-In which age group do you more frequently perform maxillary molar distalization?	Children (8-12 years)
	Adolescents (13-18 years)
	Adults (18+ years)
Q9-Do you generally extract third molars in patients for whom you plan distalization?	Yes
	No
Q10-In class II camouflage cases, do you prefer premolar extraction or molar distalization?	Distalization
	Tooth extraction
Q11-What factors influence your decision between premolar extraction and molar distalization in class II camouflage cases?	Severity of molar relationship
	Amount of crowding
	Vertical growth pattern and anterior overbite
	Soft tissue profile
	Treatment duration
	Appliance cost
	All of the above
Q12-What is the primary criterion you consider first in making the decision between premolar extraction and molar distalization in class II camouflage cases?	Severity of molar relationship
	Amount of crowding
	Vertical growth pattern and anterior overbite
	Soft tissue profile
	Treatment duration
	Appliance cost
	Others
Q13-For patients where you indicate maxillary molar distalization, do you use extraoral distalization methods?	Occasionally
	Yes
	No
Q14-Which method do you more frequently use for intraoral molar distalization?	I do not use any
	Tooth- and tissue-supported distalization appliances
	Skeletal anchorage-supported distalization appliances
Q15-If you use tooth- and tissue-supported intraoral distalization appliances, which ones do you prefer?	I do not use any
	Pendulum
	Keleş Slider
	Carriere distalizer
	Frog
	Veltri
	First class
	Distal jet
	Jones jig
	ACCO
	Other
Q16-If you use skeletal anchorage-supported intraoral distalization appliances, which anatomical region do you most commonly used for anchorage?	I do not use any
	Infrazygomatic crest
	Buccal
	Maxillary tuber
	Palatinal
	Other
Q17-If you use palatal miniscrew-supported distalization appliances, which type do you prefer?	I do not use any
	Beneslider
	Modified Pendulum
	Modified Keleş Slider
	Mini screw supported frog
	Modified distal Jet
	Others
Q18-Do you routinely perform CBCT imaging before placing miniscrews in the palatal region to evaluate root positions and bone availability?	Yes
	No
	Sometimes

Table 2. Treatment approaches of maxillary molar distalization (table continues)	
Q19-In the buccal region, which type of miniscrew placement do you prefer most?	Extraradicular placement
	Interradicular placement
	I use both equally
	I do not use buccal miniscrew systems
Q20-What is the most commonly preferred screw size in extraradicular placement (infrazygomatic crest)?	2x10 mm
	2x11 mm
	2x12 mm
	2x13 mm
	2x14 mm
	I do not use infrazygomatic crest screws
	Other
Q21-Which material do you prefer for the infrazygomatic crest miniscrew?	Stainless steel miniscrew
	Titanium alloy miniscrew
	I do not use infrazygomatic crest screws
Q22-What is the biggest difficulty or complication you encounter during TAD insertion for maxillary molar distalization?	Finding sufficient bone density
	Soft tissue interference
	Device instability
	Patient discomfort and cooperation
	I do not encounter any difficulties during TAD placement
	Other
Q23-Which factor do you think most affects the success of molar distalization treatment?	Patient age
	Severity of malocclusion
	TAD placement site
	Appliance stability
	Patient cooperation
	Other
Q24-What is the average duration of treatment for maxillary molar distalization?	0-3 months
	3-6 months
	6-9 months
	9-12 months
	More than 12 months
Q25-What are the most frequently encountered complications during distalization?	Root resorption in molars
	Miniscrew loosening
	Soft tissue irritation
	Miniscrew fracture
	No complications encountered
	Other
Q26-What is your average miniscrew failure rate during distalization?	0-10%
	10-20%
	20-30%
	Over 30%
Q27-What is the most common biomechanical challenge you face during molar distalization?	Unwanted tooth movement
	Poor vertical control
	Occlusal plane discrepancies
	Insufficient distalization
	No biomechanical difficulties encountered
	Other
Q28-How would you rate patient compliance during distalization?	Excellent
	Good
	Moderate
	Poor
Q29-Which clinical protocol do you most commonly follow?	I initiate molar distalization separately at the beginning of treatment, proceed to the retention phase after achieving a class I or super class I molar relationship, and then begin fixed orthodontic treatment following retention.
	I initiate molar distalization separately at the beginning of treatment and proceed directly to fixed orthodontic treatment immediately after achieving a Class I or super Class I molar relationship.
	I initiate molar distalization separately at the beginning of treatment and proceed to fixed orthodontic treatment before achieving a class I or super class I molar relationship.
	I start fixed orthodontic treatment before distalization, and once the appropriate stage is reached, I perform total maxillary arch distalization using archwires.

CBCT: Cone-beam computed tomography, TAD: Temporary anchorage devices

Table 3. Clear aligner and retention approaches for maxillary molar distalization treatment	
Q30- Do you prefer clear aligners for distalization indications in your clinical practice?	Yes
	No
Q31- If you use clear aligners, which brand do you use most frequently?	ClearCorrect
	FAS Aligner System
	Inhouse aligner
	Invisalign
	Orthero
	I do not use clear aligners for distalization indications.
	Other
Q32- In your distalization cases treated with clear aligners, which sequential distalization strategy do you prefer?	33% sequential distalization
	50% sequential distalization
	I move all teeth simultaneously.
	I do not use clear aligners for distalization indications.
Q33- At which stage do you start using class II elastics in your distalization cases treated with clear aligners?	From the beginning of treatment
	When the first premolar starts to move distally
	When the second premolar starts to move distally
	When the canine starts to move distally
	I do not use elastics
Q34- After how many millimeters of distalization do you apply skeletal anchorage support when using clear aligners?	2 mm
	3 mm
	4 mm
	5 mm
	6 mm
	I do not use clear aligners for distalization indications.
Q35- How do you manage the retention phase after completing the distalization stage?	I start fixed treatment with class II elastic support without waiting for the retention period.
	I keep the distalization appliance in the mouth for a while.
	I remove the distalization appliance and use a different appliance for full-time or part-time retention.
	I remove the distalization appliance and apply skeletal anchorage support (mini screw).
	I do not apply any mechanics and directly begin fixed treatment.
	Other
Q36- How do you manage the retention phase after completing fixed orthodontic treatment in patients treated with distalization?	I use Essix retainer
	I use lingual retainer
	I use both Essix and lingual retainer
	I use Hawley retainer
	I use a different appliance that I have designed myself or obtained externally
Q37- How do you evaluate the relapse rate following upper molar distalization?	No relapse observed
	Low rate (0%-10%)
	Moderate rate (10%-30%)
	High rate (≥30%)

aim of the study was to describe general trends in clinical preferences. In cases where the assumptions of the Chi-square test were not met due to expected frequencies falling below 5 in certain cells of the contingency tables, the Monte Carlo simulation method was applied using 10,000 iterations. This approach provided more robust and reliable p-values, particularly in low-frequency cells. All statistical analyses were performed using SPSS Version 22.0, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 132 orthodontists participated in this study. The gender distribution was relatively balanced, with 54.5% (n=72) female and 45.5% (n=60) male participants. In terms

Table 4. Frequency and percentage distributions of responses to the survey questions

		n	%			n	%
Q1	Male	60	45.5	Q15	Frog	2	1.5
	Female	72	54.5		Distal jet	20	15.2
Q2	20-25	4	3.0		Jones jig	2	1.5
	26-30	56	42.4		ACCO	8	6.1
	31-35	41	31.1		Other	6	4.6
	36-40	13	9.8		I do not use any	4	3.1
	Over 40	18	13.6	Q16	Infrazygomatic crest	83	62.9
Q3	Dental health center	2	1.5		Buccal	21	15.9
	University hospital	94	71.2		Maxillary tuber	2	1.5
	Private clinic	36	27.3		Palatinal	22	16.7
Q4	Research assistant	61	46.2	Q17	I do not use any	44	33.3
	Specialist dentist	38	28.8		Beneslider	17	12.9
	Lecturer	2	1.5		Modified Pendulum	12	9.1
	Assistant professor	20	15.2		Modified Keleş Slider	38	28.8
	Associate professor	6	4.5		Miniscrew supported frog	2	1.5
	Professor	5	3.8		Modified distal jet	14	10.6
Q5	0-3 years	28	21.2		Others	5	4.0
	3-6 years	54	40.9	Q18	Yes	35	27.3
	6-10 years	17	12.9		No	56	43.8
	Over 10 years	33	25.0		Sometimes	37	28.9
Q6	Yes	132	100.0	Q19	Extraradicular	52	40.0
	No	0	0		Interradicular	44	33.8
Q7	Panoramic	118	89.4		I use both equally	26	20.0
	Cephalometric	54	40.9		I do not use	8	6.2
	CBCT	15	11.4		2x10 mm	7	5.3
	Digital setup	11	8.3		2x11 mm	3	2.3
Q8	Children	12	9.1	Q20	2x12 mm	91	68.9
	Adolescents	103	78.0		2x14 mm	11	8.3
	Adults	17	12.9		I do not use	18	13.6
Q9	Yes	124	93.9		Other	2	1.51
	No	8	6.1		Stainless steel	72	54.5
Q10	Distalization	48	36.4	Q21	Titanium alloy	43	32.6
	Tooth extraction	84	63.6		I do not use	17	12.9
Q11	Molar relationship	74	56.1	Q22	Bone density	63	47.7
	Crowding	64	48.5		Soft tissue	41	31.1
	Vertical growth	59	44.7		Device instability	32	24.2
	Soft tissue profile	50	37.9		Patient discomfort	29	22.0
	Treatment duration	24	18.2		I don't any difficulties	20	15.2
	Appliance cost	5	3.8		Other	1	0.8
	All of the above	41	31.1		Patient age	26	19.7
Q12	molar relationship	49	37.1	Q23	Severitymalocclusion	50	37.9
	Crowding	32	24.2		TAD placement site	38	28.8
	Vertical growth	28	21.2		Appliance stability	57	43.2
	Soft tissue profile	18	13.6		Patient cooperation	47	35.6
	Treatment duration	3	2.3		Other	3	2.3
	Others	2	1.5	Q24	0-3 months	1	0.8
Q13	Occasionally	26	19.7		3-6 months	50	37.9
	Yes	13	9.8		6-9 months	58	43.9
	No	93	70.5		9-12 months	18	13.6
Q14	I do not use any	2	1.5		More than 12 months	5	3.8
	Tooth-tissue support	18	13.6	Q25	Root resorption molars	4	3.0
	Skeletal anchorage	112	84.8		Miniscrew loosening	94	71.2

Table 4. Frequency and percentage distributions of responses to the survey questions (table continues)

Q15	I do not use any	42	31.8	Q25	Soft tissue irritation	66	50.0
	Pendulum	45	34.1		Miniscrew fracture	3	2.3
	Keleş slider	50	37.9		No complications	7	5.3
	Carriere distalizer	8	6.1		Other	3	2.3
Q26	0-10%	53	40.2	Q33	beginning of treatment	26	19.7
	10-20%	44	33.3		first premolar starts move	16	12.1
	20-30%	28	21.2		second premolar starts move	47	35.6
	Over 30%	7	5.3		canine starts to move	6	4.5
Q27	Unwanted tooth movement	36	27.3	Q34	I do not use elastics	2	1.5
	Poor vertical control	21	15.9		From the beginning	26	19.7
	Occlusal plane discrepancies	43	32.6		2 mm	13	9.8
	Insufficient distalization	80	60.6		3 mm	55	41.7
	No biomechanical difficulties	8	6.1		4 mm	25	18.9
	Other	2	1.5		5 mm	2	1.5
Q28	Excellent	2	1.5		6 mm	1	0.8
	Good	63	47.7		I do not use	36	27.3
	Moderate	64	48.5		fixed treatment with class II elastic	21	15.9
	Poor	3	2.3		keep the distalization appliance	76	57.6
Q29	Molar distalization and retention phase	11	8.3	Q35	I use a different appliance	5	3.8
	Molar distalization and immediately orthodontic treatment	47	35.6		I apply skeletal anchorage	16	12.1
	Molar distalization and orthodontic treatment before class I relationship	10	7.6		I do not apply any mechanics	10	7.6
	Orthodontic treatment and total arch distalization	64	48.5		Other	4	3.0
Q30	Yes	89	67.4	Q36	I use Essix retainer	24	18.2
	No	43	32.6		I use lingual retainer	9	6.8
Q31	ClearCorrect	14	10.6		I use both	95	72.0
	FAS Aligner System	1	0.8		I use Hawley retainer	3	2.3
	Inhouse aligner	2	1.5		I use a different appliance	1	0.8
	Invisalign	75	56.8		No relapse observed	10	7.6
	Orthero	7	5.3		Low rate (0%-10%)	73	55.3
	I do not use	33	25.0	Q37	Moderate rate (10%-30%)	42	31.8
Q32	33% sequential distalization	48	36.4		High rate (≥30%)	7	5.3
	50% sequential distalization	47	35.6				
	Move all teeth simultaneously	35	26.5				
	I do not use clear aligners for distalization	2	1.5				

Note: This table presents the frequency (n) and percentage (%) distributions of all responses to the structured questionnaire items administered to orthodontists. Percentages are calculated based on the total number of valid responses per item. Multiple-response questions were allowed for some items, and their percentages may exceed 100%. CBCT: Cone-beam computed tomography, TAD: Temporary anchorage devices

of age, the majority (42.4%, n=56) were between 26-30 years, followed by 31-35 years (31.1%, n=41), 40 years and above (13.6%, n=18), 36-40 years (9.8%, n=13), and 20-25 years (3.0%, n=4) (Table 4).

Regarding the institution type, most participants were working in university hospitals (71.2%, n=94), followed by private clinics or polyclinics (27.3%, n=36), and public dental health centers (1.5%, n=2). The academic and professional title distribution showed that 46.2% (n=61) were research assistants, 28.8% (n=38) specialist dentists, 15.2% (n=20) assistant professors, 4.5% (n=6) associate professors, 3.8% (n=5) professors, and 1.5% (n=2) lecturers (Table 4).

According to professional experience, 40.9% (n=54) had been practicing orthodontics for 3-6 years, 25.0% (n=33) for 10 years or more, 21.2% (n=28) for 0-3 years, and 12.9% (n=17) for 6-10 years.

All respondents reported applying upper molar distalization in their clinical practice. A large majority (89.4%) indicated using panoramic radiographs in distalization planning, followed by cephalometric radiographs (40.9%), cone beam computed tomography (CBCT) (11.4%), and digital setup/3D modeling (8.3%). Distalization was most frequently performed in adolescent patients (78.0%), with lower frequencies in adults (12.9%) and children (9.1%). Most respondents (93.9%) reported routinely extracting third molars before initiating distalization (Table 4).

In class II camouflage cases, 63.6% of orthodontists preferred upper premolar extraction, while 36.4% opted for molar distalization. Factors influencing this decision included severity of molar relationship (56.1%), amount of crowding (48.5%), vertical growth pattern and overbite depth (44.7%), and soft tissue profile (37.9%). The molar relationship was the most frequently cited primary factor (37.1%) during initial assessment (Table 4).

Regarding extraoral appliances, 70.5% reported never using them, 19.7% used them occasionally, and only 9.8% used them regularly. For intraoral distalization, skeletal anchorage-supported systems were preferred by 84.8% of participants, whereas 13.6% used tooth- and tissue-supported appliances. The most commonly used conventional appliances were Keles Slider (37.9%), Pendulum (34.1%), and Distal Jet (15.2%) (Table 4).

For skeletal anchorage site selection, the most preferred location was the infrazygomatic crest (62.9%), followed by the palatal region (16.7%) and buccal region (15.9%). Among palatal anchorage systems, modified Keles Slider (28.8%), Beneslider (12.9%), and modified Pendulum (9.1%) were the most frequently used. While 43.8% of respondents did not use CBCT prior to palatal miniscrew placement, 27.3% routinely used it, and 28.9% used it selectively (Table 4).

In buccal miniscrew applications, 40.0% preferred extraradicular placement, 33.8% used interradicular placement, and 20.0% used both equally. The most common screw size in the infrazygomatic region was 2×12 mm, reported by 68.9% of participants. Regarding material preference, 54.5% used stainless steel and 32.6% used titanium alloy screws (Table 4).

The most common difficulty encountered during TAD placement was inadequate bone density (47.7%), followed by soft tissue interferences (31.1%) and device stability issues (24.2%). Factors perceived as most critical to treatment success included appliance stability (43.2%), severity of malocclusion (37.9%), and patient cooperation (35.6%). Average distalization duration was reported as 6-9 months by 43.9% and 3-6 months by 37.9% of the respondents (Table 4).

The most frequently observed complications during distalization were miniscrew loosening (71.2%) and soft tissue irritation (50.0%). A total of 40.2% reported a miniscrew failure rate between 0-10%, and 33.3% between 10-20%. The most common biomechanical challenge was insufficient distalization (60.6%), followed by occlusal plane disturbances (32.6%) and unwanted tooth movements (27.3%) (Table 4).

Regarding patient compliance, 48.5% rated it as “moderate” and 47.7% as “good.” In clinical practice, 48.5% reported initiating full arch distalization before fixed treatment, whereas 35.6% transitioned to fixed appliances after completing molar distalization (Table 4).

A total of 67.4% of clinicians reported using clear aligners for distalization cases. Among them, Invisalign was the most preferred brand (56.8%). Regarding distalization strategy, 33% staging (36.4%) and 50% staging (35.6%) were the most common. Class II elastics were typically initiated during the distal movement of the second premolars (35.6%). Respondents reported initiating skeletal anchorage support after approximately 3 mm of distalization (Table 4).

After the active distalization phase, 57.6% of clinicians kept the appliance in place temporarily for retention, while 15.9% moved directly into fixed treatment with class II elastics without a retention phase. The most commonly used post-treatment retention method was a combination of Essix retainer and lingual fixed retainer (72.0%). In terms of relapse, 55.3% reported a low relapse rate (0-10%), while 31.8% observed relapse between 10-30% (Table 4).

The study also examined the influence of demographic factors-such as age, gender, workplace type, and years of experience-on clinical decisions regarding appliance selection, skeletal anchorage use, and clear aligner applications. Statistical analyses revealed that age and gender had no significant impact on clinical preferences ($p>0.05$) (Table 5).

When clinical preferences were compared by institution type, four items showed statistically significant differences ($p<0.05$). Panoramic radiographs were more frequently used in private clinics, while cephalometric and CBCT imaging were more common in universities and public institutions (Q7). The infrazygomatic crest was more preferred in universities/public settings for TAD placement, while palatal placement was more common in private clinics (Q16). Stainless steel miniscrews were used more often in university settings (Q21), and clear aligners were significantly more common in private practice (Q30). No significant associations were found between institution type and other clinical variables ($p>0.05$), indicating a general standardization in many treatment approaches (Table 5).

Table 5. Chi-square test results: effects of gender, age, institution type and academic title on clinical preferences				
Questions	**Effect of gender (p)**	**Effect of age (p)**	**Effect of institution type (p)**	**Effect of academic title (p)**
Q-7	>0.05	>0.05	0.048*	>0.05
Q-16	>0.05	>0.05	0.017*	0.004**
Q-21	>0.05	>0.05	0.0005***	0.017*
Q-30	>0.05	>0.05	0.006**	0.021*
Q-31	>0.05	>0.05	>0.05	0.016*
Q-32	>0.05	>0.05	>0.05	0.010**
Q-33	>0.05	>0.05	>0.05	0.024*
Q-34	>0.05	>0.05	>0.05	0.009**
Other questions	>0.05	>0.05	>0.05	> 0.05
Statistically significant associations (p<0.05) are indicated. Non-significant results are presented as >0.05. *p<0.05; **p<0.01; **p<0.001				

Further analysis by academic rank revealed significant differences in some items (p<0.05). In Q16, research assistants mostly preferred the infrazygomatic crest, while faculty members more frequently chose the palatal region. In Q21, stainless steel screws were the most used in all groups, but titanium preference was higher among specialists. Regarding clear aligners, specialists reported the highest usage (Q30), Invisalign was the most commonly used brand across all groups (Q31), and 50% staging was more common among faculty and specialists, while 33% staging was preferred by research assistants (Q32). In Q33, specialists were more likely to initiate class II elastics during second premolar movement. In Q34, while most clinicians reported using skeletal anchorage after 3 mm of movement, this was more pronounced among faculty. No significant differences were found in other questions based on academic title (p>0.05) (**Table 5**).

DISCUSSION

In managing angle class II dental malocclusions, two common approaches for addressing maxillary anterior crowding and increased overjet include the distal movement of maxillary molars or the extraction of premolars. Advances in mechanotherapy and evolving treatment philosophies have significantly reduced the reliance on premolar extractions in various malocclusion types. Borderline cases, however, continue to present clinical challenges and differing opinions among practitioners. It has been suggested that approximately 25-30% of orthodontic patients may benefit from maxillary arch expansion, while up to 95% of class II cases could potentially be improved through a combination of molar rotation, distalization, and expansion.[7,16,17]

To the best of our knowledge, there is no prior survey-based study in the literature that specifically evaluates clinicians' preferences regarding the use of distalization methods in the treatment of class II malocclusions. In this context, the present study contributes to the field by exploring the distalization strategies adopted by orthodontists.

Upper molar distalization in orthodontics is commonly performed using extraoral or intraoral approaches. While headgear has shown clinical effectiveness, its use has declined due to aesthetic concerns, reliance on patient compliance, and reported complications such as soft tissue irritation and muscle strain.[18,19] These limitations have prompted a shift toward intraoral appliances, which offer continuous force application without the need for extraoral support. However, these systems often lead to anchorage loss in premolars and incisors, and when these teeth are later repositioned, further anchorage challenges and treatment delays may occur.[20]

Recent advancements in skeletal anchorage systems, particularly buccal and palatal miniscrew-supported mechanics, have enabled effective distalization in managing even severe class II malocclusions. These systems provide superior three-dimensional control, minimize unwanted side effects, and significantly reduce the risk of anchorage loss, thereby diminishing the need for extractions or extraoral devices.[5]

In this study, all respondents indicated that they incorporate upper molar distalization into their clinical practice. This finding suggests that, although not always the primary treatment choice-particularly in cases where premolar extraction is preferred-distalization remains a widely accepted and routinely utilized approach in managing specific malocclusion patterns.

Panoramic radiographs were the most frequently preferred imaging modality during distalization planning, likely due to their ease of use, low cost, and ability to provide basic diagnostic information.[21] Although cephalometric radiographs and CBCT offer more detailed skeletal and three-dimensional assessments, their relatively limited use may reflect practical constraints such as radiation concerns, availability, or institutional routines.[22] The low utilization of digital setup and 3D modeling also indicates that these technologies, while promising, have not yet become standard in everyday clinical workflows.

The majority of clinicians reported performing distalization most frequently in adolescent patients (78%), which aligns with the optimal timing for molar movement due to favorable growth potential and anchorage conditions during this period.[23]

A large proportion of respondents (93.9%) indicated that they routinely extract third molars before initiating distalization. This common practice is likely aimed at preventing eruption-related interferences and facilitating unobstructed molar

movement, as supported by previous studies recommending the removal of third molars to optimize distalization efficiency.[24,25]

Despite the widespread use of distalization, 63.6% of clinicians reported favoring premolar extraction over distalization in class II camouflage cases. This preference may reflect the greater predictability and anchorage control associated with extraction protocols, especially in patients with significant crowding or pronounced skeletal discrepancies. The decision appears to be shaped not only by treatment mechanics but also by factors such as malocclusion severity and long-term stability considerations.

Although distalization is widely utilized in clinical practice, a majority of clinicians (63.6%) reported preferring premolar extraction over distalization for class II camouflage treatment. According to the responses, this decision was primarily influenced by the severity of the molar relationship, the amount of crowding, the patient's vertical growth pattern or overbite depth, and the soft tissue profile. When asked about the 'primary criterion' considered during initial assessment, the molar relationship was again the most commonly selected factor (37.1%), highlighting its dominant role in treatment planning. These findings suggest that treatment planning is multifactorial, and clinicians weigh skeletal and dental characteristics carefully when determining whether to choose extraction or distalization.[26]

Extraoral distalization appliances were rarely used, with 70.5% of clinicians reporting that they do not incorporate them into treatment. This low preference is likely related to aesthetic concerns, limited patient compliance, and the availability of more effective intraoral alternatives.[5]

Intraoral distalization was predominantly performed using skeletal anchorage-supported systems, preferred by 84.8% of clinicians, while only 13.6% reported using tooth- and tissue-supported appliances. This finding reflects the growing reliance on miniscrew-assisted mechanics due to their superior anchorage control and reduced side effects.[17] Among traditional appliances, the Keleş Slider (37.9%) and Pendulum (34.1%) remained the most frequently used, indicating that despite the shift toward skeletal anchorage, conventional systems still hold a place in selected cases.

Clinicians in this study most frequently preferred the infrazygomatic crest (62.9%) as the site for skeletal anchorage placement, with lower rates for palatal (16.7%) and buccal (15.9%) regions. This preference may be attributed to the IZC region's favorable cortical bone density, ease of access without the need for complex appliances, and cost-effectiveness compared to palatal systems that often require custom laboratory components.[27] Additionally, its compatibility with direct force application makes it a practical choice in routine clinical settings.[28]

Among palatal miniscrew-supported systems, the most commonly preferred appliance was the modified Keleş Slider (28.8%), followed by the Beneslider (12.9%) and the modified Pendulum (9.1%). These preferences may reflect clinicians' familiarity with specific biomechanics, ease of appliance activation, and prior clinical training. The modified Keleş Slider, in particular, offers controlled molar movement with minimal reliance on patient compliance, which may explain its frequent use in palatal anchorage protocols.[29] Despite the anatomical complexity of the palatal region, only 27.3% of clinicians reported routinely using CBCT prior to miniscrew placement, while 43.8% did not use it at all. Given the risk of root damage and the need for precise identification of adequate bone volume, CBCT imaging is often considered essential in planning safe and effective miniscrew insertion.[30] The limited use observed in this study may be attributed to factors such as radiation concerns, additional cost, or lack of routine access to CBCT in certain clinical environments.

In the buccal region, clinicians showed a slight preference for extraradicular miniscrew placement (40.0%) over interradicular sites (33.8%). This may be due to the increased risk of root proximity in interradicular applications, especially when anatomical spacing is limited. Extraradicular sites may offer more consistent cortical engagement and lower risk of root contact, making them a safer option in selected cases.[31] The remaining clinicians reported using both approaches equally, likely adapting their choice based on individual anatomical considerations.

The 2×12 mm miniscrew was the most commonly preferred dimension in this study (68.9%), aligning with previous literature suggesting that this length offers optimal balance between mechanical stability and safety in extra-alveolar sites such as the infrazygomatic crest. Its sufficient length ensures effective cortical engagement while minimizing the risk of root proximity or maxillary sinus perforation. Regarding material preference, stainless steel miniscrews were selected more frequently (54.5%) than titanium (32.6%), likely due to their higher fracture resistance and cost-effectiveness in high-stress clinical applications.[32] Although titanium is known for its superior biocompatibility, its increased flexibility and higher cost[33] may limit its routine use in heavy-load mechanics like distalization.

The most frequently reported challenge during TAD placement was inadequate bone density (47.7%), a finding consistent with previous studies emphasizing the importance of cortical bone thickness for primary stability.[34] Insufficient bone support may compromise miniscrew retention, particularly in anatomically variable regions such as the infrazygomatic crest or palatal slope. Soft tissue interference (31.1%) and appliance instability (24.2%) were also noted as limiting factors. Notably, appliance stability (43.2%) was cited as the most critical determinant of treatment success, followed by malocclusion severity (37.9%) and patient cooperation (35.6%), reflecting the multifactorial demands of effective distalization mechanics.

Most clinicians reported an average distalization duration of 6-9 months (43.9%), which is consistent with previous studies reporting similar treatment timelines for molar distalization using both skeletal and conventional intraoral mechanics.[35,36] Variations in treatment duration may depend on factors such as the amount of distal movement required, appliance design, and anchorage quality.

The most commonly reported complication during distalization was miniscrew loosening (71.2%), followed by

soft tissue irritation (50.0%). These findings are consistent with previous studies identifying primary stability loss and soft tissue overgrowth as frequent issues in TAD-based mechanics.[37,38] Despite these complications, most clinicians reported relatively low miniscrew failure rates, with 40.2% estimating a loss rate between 0-10%, and 33.3% between 10-20%. The most frequent biomechanical challenge was insufficient distalization (60.6%), likely related to anatomical limitations or force application inefficiencies, while occlusal plane alterations and unwanted tooth movements were reported to a lesser extent.

Following active distalization, the majority of clinicians (57.6%) preferred maintaining the appliance intraorally for a period to ensure retention before initiating fixed therapy. This strategy may enhance post-distalization stability by allowing for periodontal and occlusal adaptation. After comprehensive treatment, the most commonly used retention protocol was a combination of Essix and lingual retainers (72.0%), likely reflecting efforts to minimize relapse risk through dual mechanical control. Despite these precautions, 31.8% of respondents reported moderate relapse rates (10-30%), suggesting that even with reinforcement, distalized molars may be susceptible to post-treatment movement.

With rising aesthetic demands and advancements in aligner technology, clear aligners have become a viable option for performing complex tooth movements, including molar distalization. In this study, 67.4% of clinicians reported using aligners for distalization, with Invisalign being the most preferred brand (56.8%). This finding aligns with recent surveys and clinical reports indicating a growing reliance on clear aligners for class II correction, particularly among practitioners seeking aesthetic, compliance-friendly alternatives.[39] Sequential distalization protocols were common, with 33% and 50% staging strategies most frequently employed-an approach shown to improve anchorage control and reduce undesired reciprocal movements.[40] Notably, 35.6% of respondents initiated class II elastic use during the distalization of the second premolars, which is consistent with current recommendations that favor delayed elastic engagement to prevent premature anchorage loss.[41] Furthermore, clinicians reported initiating skeletal anchorage-typically in the form of palatal TADs-after an average of 3 mm of distal movement, reflecting the limitations of aligners alone in achieving bodily molar translation without auxiliary support. This threshold is consistent with previous clinical and biomechanical studies suggesting that clear aligners can predictably achieve 2-3 mm of molar distalization, though primarily with distal tipping rather than bodily movement.[42] Beyond this point, the incorporation of TADs or class II elastics has been shown to significantly improve anchorage control and enhance the efficiency of posterior tooth movement.

This study also explored the potential influence of demographic and professional variables on clinical decision-making. While factors such as age and gender showed no significant association with treatment preferences, institutional setting and professional experience were found to impact specific choices-particularly in imaging modality, anchorage site selection, and clear aligner use. For example, university-based clinicians more frequently preferred infrazygomatic anchorage and steel alloy miniscrews, whereas private practitioners showed greater use of palatal TADs and aligner therapy. Additionally, variations were observed across academic titles, suggesting that training background and clinical exposure may influence appliance selection and biomechanics. These findings indicate that, although many clinical approaches appear standardized, institutional resources and practitioner experience can still shape treatment planning in molar distalization.

Limitations

While the results offer valuable insights into treatment preferences, they are based on self-reported data and may be influenced by recall bias or institutional variability. Additionally, the number of participants could have been higher to further strengthen the generalizability of the findings. Future studies with clinical outcome data and broader international samples are needed to validate these patterns and inform evidence-based protocols. Moreover, multivariate modeling approaches are recommended in future research to evaluate the independent effects of variables such as age, clinical experience, and academic title, which were not explored in the current study.

CONCLUSION

This survey-based study provides a comprehensive overview of current clinical practices among orthodontists in Turkiye regarding maxillary molar distalization. The findings indicate a strong preference for skeletal anchorage-supported intraoral appliances, particularly those utilizing infrazygomatic crest and palatal insertion sites. Although distalization is widely utilized, premolar extraction remains the more common approach in class II camouflage cases. Clear aligner systems have gained significant popularity, especially when combined with sequential staging and auxiliary anchorage. Despite these advancements, concerns such as miniscrew stability, anatomical limitations, and relapse remain critical factors influencing treatment success. These results highlight the need for individualized biomechanical planning and continued evaluation of long-term clinical outcomes in distalization therapy.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the İnönü University Scientific Researches and Publication Ethics Committee (Date: 24.09.2024, Decision No: 2024/6452).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Angle EH. Classification of malocclusion. *Dent Cosmos*. 1899;41:350-357.
2. Stomatologic S. Worldwide prevalence of malocclusion in the different stages of dentition: a systematic review and meta-analysis. *Eur J Paediatr Dent*. 2020;21(2):115-122. doi:10.23804/ejpd.2020.21.02.05
3. Gelgör IE, Karaman IA, Ercan E. Prevalence of malocclusion among adolescents in central Anatolia. *Eur J Dent*. 2007;1(3):125-131. doi:10.1055/s-0039-1698327
4. Graber T, Swain B. Orthodontics Current Principles and Techniques. St. Louis: CV Mosby Co; 1985:681.
5. Oğuz F, Özden S, Cicek O. Distalization methods for maxillary molars utilizing temporary anchorage devices (TADs): a narrative review. *Appl Sci*. 2024;14(23):11333. doi:10.3390/app142311333
6. Bowman SJ, Johnston LE Jr. The esthetic impact of extraction and nonextraction treatments on Caucasian patients. *Angle Orthod*. 2000;70(1):3-10. doi:10.1043/0003-3219(2000)070<0003:TEIOEA>2.0.CO;2
7. Abdelhady NA, Tawfik MA, Hammad SM. Maxillary molar distalization in treatment of angle class II malocclusion growing patients: uncontrolled clinical trial. *Int Orthod*. 2020;18(1):96-104. doi:10.1016/j.ortho.2019.11.003
8. Grec RH, Janson G, Branco NC, Moura-Grec PG, Patel MP, Castanha Henriques JF. Intraoral distalizer effects with conventional and skeletal anchorage: a meta-analysis. *Am J Orthod Dentofacial Orthop*. 2013;143(5):602-615. doi:10.1016/j.ajodo.2012.11.024
9. Kırcalı M, Yüksel AS. Evaluation of dentoalveolar and dentofacial effects of a mini-screw-anchored pendulum appliance in maxillary molar distalization. *Turk J Orthod*. 2018;31(4):103-109. doi:10.5152/TurkJOrthod.2018.18004
10. AlSeraidi M, Hansa I, Dhaval F, Ferguson DJ, Vaid NR. The effect of vestibular, lingual, and aligner appliances on the quality of life of adult patients during the initial stages of orthodontic treatment. *Prog Orthod*. 2021;22(1):3. doi:10.1186/s40510-020-00346-0
11. Weir T. Clear aligners in orthodontic treatment. *Aust Dent J*. 2017;62(Suppl 1):58-62. doi:10.1111/adj.12480
12. Drake CT, McGorray SP, Dolce C, Nair M, Wheeler TT. Orthodontic tooth movement with clear aligners. *ISRN Dent*. 2012;2012:657973. doi:10.5402/2012/657973
13. Simon M, Keilig L, Schwarze J, Jung BA, Bourauel C. Treatment outcome and efficacy of an aligner technique-regarding incisor torque, premolar derotation and molar distalization. *BMC Oral Health*. 2014;14:68. doi:10.1186/1472-6831-14-68
14. Bearn DR. Bonded orthodontic retainers: a review. *Am J Orthod Dentofacial Orthop*. 1995;108(2):207-213. doi:10.1016/s0889-5406(95)70085-4
15. Pandis N, Vlahopoulos K, Madianos P, Eliades T. Long-term periodontal status of patients with mandibular lingual fixed retention. *Eur J Orthod*. 2007;29(5):471-476. doi:10.1093/ejo/cjm042
16. Corbett MC. Slow and continuous maxillary expansion, molar rotation, and molar distalization. *J Clin Orthod*. 1997;31(4):253-263.
17. Soheilifar S, Mohebi S, Ameli N. Maxillary molar distalization using conventional versus skeletal anchorage devices: a systematic review and meta-analysis. *Int Orthod*. 2019;17(3):415-424. doi:10.1016/j.ortho.2019.06.002
18. Bolla E, Muratore F, Carano A, Bowman SJ. Evaluation of maxillary molar distalization with the distal jet: a comparison with other contemporary methods. *Angle Orthod*. 2002;72(5):481-494. doi:10.1043/0003-3219(2002)072<0481:EOMMDW>2.0.CO;2
19. Samuels RH, Jones ML. Orthodontic facebow injuries and safety equipment. *Eur J Orthod*. 1994;16(5):385-394. doi:10.1093/ejo/16.5.385
20. Bondemark L, Karlsson I. Extraoral vs intraoral appliance for distal movement of maxillary first molars: a randomized controlled trial. *Angle Orthod*. 2005;75(5):699-706. doi:10.1043/0003-3219(2005)75[699:EVIAFD]2.0.CO;2
21. Izzetti R, Nisi M, Aringhieri G, Crocetti L, Graziani F, Nardi C. Basic knowledge and new advances in panoramic radiography imaging techniques: a narrative review on what dentists and radiologists should know. *Appl Sci*. 2021;11(17):7858. doi:10.3390/app11177858
22. De Vos W, Casselman J, Swennen G. Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: a systematic review of the literature. *Int J Oral Maxillofac Surg*. 2009;38(6):609-625. doi:10.1016/j.ijom.2009.02.028
23. Ruan MJ, Chen G, Xu TM. Comparison of orthodontic tooth movement between adolescents and adults based on implant superimposition. *PLoS One*. 2018;13(5):e0197281. doi:10.1371/journal.pone.0197281
24. Aboalnaga AA, Fouda AS. Evaluation of the effect of extraction in comparison to distalization on the maxillary third molars in class II malocclusion: a retrospective study. *Clin Oral Investig*. 2024;28(3):191. doi:10.1007/s00784-024-05576-8
25. Kassem NM, Farouk K. Effect of upper third molar extraction on distalization using carriere motion appliance: a prospective clinical study. *Al-Azhar J Dent Sci*. 2024;27(3):407-416. doi:10.21608/ajdsm.2022.174768.1384
26. Alsaggaf DH, Afify AR, Zawawi KH, Alsulaimani FF. Factors influencing the orthodontic treatment plan in class II malocclusion. *Am J Orthod Dentofacial Orthop*. 2022;161(6):829-837.e1. doi:10.1016/j.ajodo.2021.01.034
27. Chang C, Huang C, Roberts WE. 3D cortical bone anatomy of the mandibular buccal shelf: a CBCT study to define sites for extra-alveolar bone screws to treat class III malocclusion. *Int J Orthod Implantol*. 2016;41(1):74-82.
28. Wu X, Liu H, Luo C, Li Y, Ding Y. Three-dimensional evaluation on the effect of maxillary dentition distalization with miniscrews implanted in the infrazygomatic crest. *Implant Dent*. 2018;27(1):22-27. doi:10.1097/ID.0000000000000706
29. Özdemir G. Kemik ve diş-doku destekli keleş slider apareylerinin etkilerinin 3 boyutlu görüntüleme yöntemiyle karşılaştırılması. Doktora Tezi, Atatürk Üniversitesi Sağlık Bilimleri Enstitüsü, 2013.
30. Jakovljevic I, Vasiljevic M, Milanovic J, et al. Importance of CBCT analysis in the preoperative planning of TAD placement in the anterior maxillary region. *Appl Sci*. 2025;15(12):6866. doi:10.3390/app15126866
31. Truong VM, Kim S, Kim J, Lee JW, Park YS. Revisiting the complications of orthodontic miniscrew. *Biomed Res Int*. 2022;2022:8720412. doi:10.1155/2022/8720412
32. Liou EJ, Pai BC, Lin JC. Do miniscrews remain stationary under orthodontic forces? *Am J Orthod Dentofacial Orthop*. 2004;126(1):42-47. doi:10.1016/j.ajodo.2003.06.018
33. Mecenas P, Espinosa DG, Cardoso PC, Normando D. Stainless steel or titanium mini-implants? *Angle Orthod*. 2020;90(4):587-597. doi:10.2319/081619-536.1
34. Miyawaki S, Koyama I, Inoue M, Mishima K, Sugahara T, Takano-Yamamoto T. Factors associated with the stability of titanium screws placed in the posterior region for orthodontic anchorage. *Am J Orthod Dentofacial Orthop*. 2003;124(4):373-378. doi:10.1016/s0889-5406(03)00565-1
35. Memè L, Bambini F, Del Vecchio G, et al. Dental distalization techniques with clear aligners: a narrative review. *Oral Implantol*. 2024;16(3 Suppl 1):461-475. doi:10.11138/oi163.1suppl461-475
36. Papadopoulos MA, Tarawneh F. The use of miniscrew implants for temporary skeletal anchorage in orthodontics: a comprehensive review. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2007;103(5):e6-e15. doi:10.1016/j.tripleo.2006.11.022
37. Chen YJ, Chang HH, Huang CY, Hung HC, Lai EH, Yao CC. A retrospective analysis of the failure rate of three different orthodontic skeletal anchorage systems. *Clin Oral Implants Res*. 2007;18(6):768-775. doi:10.1111/j.1600-0501.2007.01405.x
38. Park HS. The use of microimplants in orthodontics. In: Current Therapy in Orthodontics. Elsevier; 2010:291-300.
39. Dianiskova S, Rongo R, Buono R, Franchi L, Michelotti A, D'Antò V. Treatment of mild class II malocclusion in growing patients with clear aligners versus fixed multibracket therapy: a retrospective study. *Orthod Craniofac Res*. 2022;25(1):96-102. doi:10.1111/ocr.12500

40. Shen C, Park TH, Chung CH, Li C. Molar Distalization by clear aligners with sequential distalization protocol: a systematic review and meta-analysis. *J Funct Biomater.* 2024;15(6):137. doi:10.3390/jfb15060137
41. Lombardo L, Colonna A, Carlucci A, Oliverio T, Siciliani G. Class II subdivision correction with clear aligners using intermaxilary elastics. *Prog Orthod*. 2018;19(1):32. doi:10.1186/s40510-018-0221-5
42. Ravera S, Castroflorio T, Garino F, Daher S, Cugliari G, Deregibus A. Maxillary molar distalization with aligners in adult patients: a multicenter retrospective study. *Prog Orthod*. 2016;17:12. doi:10.1186/s40510-016-0126-0