Original Article

Blanket or tailored prescription of retainers in orthodontics: a questionnaire-based study

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ABSTRACT

Objective: To explore retainer protocols and how they are influenced by orthodontic presentation and the nature of occlusal correction.

Materials and Methods: A prepiloted 45-item online guestionnaire targeting orthodontists was developed. The questionnaire covered clinical preferences in terms of retainer type, fabrication, and follow-up during retention; the clinical indications for adjunctive surgical procedures; and the use of active designs to mitigate relapse in specific malocclusions.

Results: A total of 206 responses were obtained. The majority of the respondents prescribed maxillary removable and mandibular fixed retainers, with almost half (49.1%) reviewing patients for more than 1 year primarily in person (95.1%). The majority prescribed vacuum-formed (69.6%) 1-mm-thick (44.3%) retainers. Only 37.3% were aware of the type of material used, with polyethylene terephthalate glycol copolymer, followed by polypropylene, being the most common. Hawley retainers were preferred following nonsurgical maxillary expansion and with suboptimal interdigitation. A preference for clear retainers and/or fixed retainers was found in open-bite cases and deep-bite cases. Supracrestal fiberotomy was prescribed commonly (61.1%) for rotations greater than 90°. No retainer was rarely prescribed except after the correction of an anterior crossbite.

Conclusions: Blanket prescription of orthodontic retention is common, with limited awareness of clear plastic retainer materials. Future trials evaluating the effectiveness of approaches for retainer prescription based on the presenting malocclusion would be timely. (Angle Orthod, 2024:94:224-232.)

KEY WORDS: Thermoplastic retainers; Frenectomy; Pericision; Stability

INTRODUCTION

While there is now a deeper understanding of the contributors to posttreatment change^{1,2} and a broadening armamentarium of mechanical options for orthodontic retention, considerable uncertainty continues to surround

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the choice of optimal retention regimes. The susceptibility of specific features to change dictates the potential value of tailored retention protocols. In particular, the stability of orthodontic treatment outcomes varies depending on the pretreatment malocclusion and the nature of orthodontic changes with, for example, anterior open-bite correction related to the extrusion of the incisors thought to have a poor prognosis for stability.³ Additionally, favorable posttreatment dental changes are sometimes required to improve interdigitation following debond.⁴ As such, the universal prescription of homogeneous regimes may be inappropriate, with nuances related to retainer selection, design, protocols, the incorporation of active elements,⁵ and the use of adjunctive procedures being possible.6

Previous guestionnaire-based studies⁷⁻¹⁰ have focused on common retention practices rather than linking these to the nature of orthodontic correction. Alterations to retention protocols, however, have been explored in national surveys regarding the management of diastema, following maxillary expansion, and in relation to open bite and severe rotations.^{11–13} It was observed that more than two-thirds of orthodontists

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prescribed fixed retention and clear plastic retainers following the closure of a maxillary midline diastema.^{11–13} A Hawley appliance^{12,13} or a clear plastic retainer¹¹ has been commonly prescribed following maxillary expansion. Clear plastic retainers, with or without fixed retention, may be more commonly prescribed following the correction of an anterior open bite than Hawley retainers.^{11,12} Dual retention, using a clear plastic retainer and a fixed retainer (FR), has been commonly prescribed following the correction of severe rotation of the maxillary anterior teeth.^{11–13} Previous questionnaires were centered primarily on orthodontist preferences in terms of fixed or removable retainers in different malocclusions, with little information being related to tailoring retainers in terms of their design, material selection, and prescription of adjunctive procedures.

Certain modifications of removable appliances have been described to mitigate different tooth movements or occlusal changes, for example, the incorporation of bite planes into removable retainers anteriorly and posteriorly following the correction of deep bite and open bite, respectively.⁵ Additionally, FRs can be altered to include the mandibular first premolars but may be confined to the upper central incisors only following midline diastema closure.¹⁴ However, the extent to which retention protocols, including the selection of retainer type and material and recall routines, are tailored on an individual basis has not been captured in previous survey-based studies. The aims of the current study, therefore, were to evaluate the prescription of different retainer protocols and surgical adjunctive procedures by orthodontists and to understand how this is influenced by the orthodontic presentation and the nature of the correction.

MATERIALS AND METHODS

A questionnaire-based survey targeting orthodontists was designed on the SurveyMonkey platform following ethical approval (Queen Mary Ethics of Research Committee, QMERC22.109). The following aspects were considered: demographics and clinical experience, clinical preference in terms of types of retainer options and follow-up during retention, retainer fabrication, clinical indications for prescribing adjunctive surgical procedures or no retainers, and specific questions related to orthodontic retainer material choice and design for different types of malocclusions.

The questionnaire was piloted twice on each of five orthodontic specialists. The following aspects were assessed: clarity of the language and readability, style and formatting consistency, and feasibility. Amendments were made accordingly until a final version, including up to 45 items, was devised.

The online questionnaire was made available on orthodontic social media platforms, including multiple closed

Table 1. Demographic Data and Work Experience (n = 206)

Questions	% of Respondents
Gender	
Male	48.4%
Female	50.5%
Other	0.5%
Prefer not to say	0.5%
Age	
< 30 years	6.8%
30–40 years	46.8%
>40–50 years	27.4%
>50 years	19%
Years of experience	
0–5 years	21.1%
>5–10 years	32.6%
>10-20 years	25.8%
>20 years	20.5%
Continent	
Asia	56.3%
Africa	6.8%
Europe	26.8%
Australia	0.5%
North America	9%
South America	0.5%
Clinical setting	
Hospital	18.4%
Private practice	59.5%
Both	22.1%

Facebook groups. A link to the questionnaire, along with accompanying explanatory information, was posted, and the survey remained open for 4 weeks after the final post.

Descriptive statistics were performed, and data were presented as frequencies and percentages. Responses to open-ended questions were also considered, coded, and reported.

RESULTS

A total of 206 responses were obtained from orthodontists with an almost equal gender distribution (Table 1). The majority of the participants (46.8%) were aged 30– 40 years and had up to 10 years of experience (53.7%). Most participants were from Asia (56.3%), followed by Europe (26.8%). More than half of the participants were working in private practice (59.5%).

Overall, respondents reported the prescription of maxillary removable retention (63.6%) and mandibular fixed retention (45%) in isolation, in more than half of their treated cases (Table 2). FRs in isolation were rarely prescribed for the maxillary arch. Dual retention using fixed and removable retainers concomitantly was slightly more prevalent in the mandibular than in the maxillary arch.

The utilization of FRs was reported to have changed over the past 5–10 years in more than half of the sample (59%). Of these, more than half reported an increase in

Table 2. Preferences for Retainer Prescription and Changes, Monitoring, Follow-Up, and Recall During Retention Among the Respondents $(n=up \ to \ 206)^a$

Questions	Findings
% of cases in which an FR only is prescribed	
Maxillary arch	
<1%	43.1%
1–25%	30.9%
>25–50%	8%
>50-75%	5.3%
>75–100%	12.8%
Mandibular arch	00.00/
< 1% 1.05%	28.0%
	18.5%
>50-75%	7.9% 8.5%
>75-100%	36.5%
% of cases in which a removable retainer	00.070
only is prescribed	
Maxillary arch	
<1%	12.1%
1–25%	16.8%
>25–50%	7.4%
>50-75%	16.8%
>75–100%	46.8%
Mandibular arch	
<1%	27.5%
1-25%	21.2%
>25-50%	9.5%
>50-75%	14.3%
% of cases in which dual retention is prescribed	27.5%
(FB and removable)	
Maxillary arch	
<1%	17.4%
1–25%	29.5%
>25–50%	14.2%
>50–75%	12.1%
>75–100%	26.8%
Mandibular arch	
<1%	16.4%
1–25%	31.8%
>25-50%	9.5%
>50-75%	12.2%
>75-100% EP retainer use over the past 5, 10 years	30.2%
Increased	31 7%
Decreased	24.2%
Unchanged	41 1%
Reasons for increased FR use (tick all that apply)	1111/0
Patient request/awareness	52.3%
Recent research findings	33.9%
Availability of new FR designs	27.7%
Relapse observed with removable retainers	70.8%
Influence of colleagues	16.9%
Other	10.8% ^b
Reasons for decreased FR use (tick all that apply)	
Patient request	31.1%
Recent research findings	46.7%
Breakages	80%
UUSI	15.0%
Time-consuming	40% 40%
Other	20% ^c
	2070

Table 2. Continued.

Questions	Findings
Methods of monitoring retention (tick all that apply)	
Proprietary remote monitoring software	2.9%
Face-to-face appointments	95.1%
Mobile application	2%
Other	2.9%
Duration of retainer follow-up period	
0–6 months	12.8%
>6 months-1 year	38.2%
>1-2 years	21.6%
>2 years	27.5%
Frequency of recall during retention	
At 3 months and 12 months	22.6%
At 6 months and 12 months	27.5%
At 3, 6, and 12 months	39.2%
Other	10.8%
Most frequent removable retainer choice	
(with 1 being the most frequent and	
3 being the least frequent)	
Hawley retainer	
1	16.7%
2	74.5%
3	8.8%
Clear plastic retainer	
1	80.4%
2	14.7%
3	4.9%
Begg wraparound retainer	
1	2.9%
2	10.8%
3	86.3%
Expected longevity of clear plastic retainers	
Up to 6 months	15.1%
Up to 1 year	44.1%
Up to 5 years	36.9%
Lifelong	3.9%

^a FR indicates fixed retainer.

^b Compliance issues with removable retainers and high relapse tendency in the lower anterior segment.

^c Space reopening in the maxillary arch, relapse with FRs, hindrance of oral hygiene measures, responsibility of long-term followup, removable retainers have similar effectiveness, demineralization, increased failure rates and periodontal issues, and COVID-driven.

their use, mainly due to relapse observed with removable retainers and patient request/awareness (Table 2). The remainder reported the reduced use of FRs due to the associated breakage, research findings, inadvertent torgue expression, and time implications.

In terms of monitoring retention, most respondents relied on face-to-face appointments (95.1%; Table 2). More than one-third of the participants (38.2%) reviewed patients for over 6 months to 1 year after the completion of active orthodontic treatment. A significant proportion (39.2%) arranged follow-up visits at 3, 6, and 12 months. Clear plastic retainers were the most commonly prescribed type of removable retainers, with 44.1% expecting these retainers to last only up to 1 year. Only 3.9% felt that clear plastic retainers could last lifelong.

Table 3. Clinical Preferences for Clear Plastic and Fixed Retainers^a

Questions	Findings, %
Clear plastic retainers	
Where clear plastic retainers are fabricated	
In-house	37.3%
External lab	43.7%
Both in-house and external lab	19%
Manufacture technique	
Pressure formed	20.9%
Vacuum formed	69.6%
Unknown	9.5%
Thickness of retainer blank	
0.5 mm	5.7%
0.75 mm	20.9%
1 mm	44.3%
	5.7%
Unknown	13.9%
Othor	0.9%
No. of clear plastic retainer sets offered	0.0%
at debond (ner arch)	
1	70 1%
2	17.1%
3	2.5%
Other	1.3%
Clear plastic retainer material known?	1.0 /0
Yes	37.3%
No	62.7%
Why used (tick all that apply)	02.17 /0
Technician/laboratory preference	41.4%
Durability/fracture resistance	39.7%
Patient comfort	53.5%
Esthetics	56.9%
Influence of colleagues	8.6%
Effectiveness in maintaining outcomes	32.8%
Unknown	1.7%
Other	13.8% ^c
FRs	
Which teeth are commonly included in FRs	
Maxillary arch	70/
1-1	7%
2-2	38.8%
3-3 Se only	51.9%
	0.0%
Mandibular arch	1.0 /8
1-1	0%
2-2	0%
3-3	91.5%
3s only	1.5%
4-4	6.9%
Material used for FRs	
SS single-strand round	2.3%
SS single-strand rectangular	3.9%
SS retainer chain	17.7%
Gold retainer chain	4.6%
Twisted ligature wires	22.3%
SS coaxial	13.9%
SS multistrand (rectangular)	6.2%
SS multistrand (flattened)	19.2%
Glass fiber-reinforced retainer	0.8%
CAD-CAM NITI	1.5%
Unknown	2.3%
Other	5.4% ^d

Table 3. Continued.

Questions	Findings, %
FR dimensions known?	
Yes	35.4%
No	64.6%
^a CD indianton fixed rateinary CC, steinlass steel	

^a FR indicates fixed retainer; SS, stainless steel.

^b Two millimeters.

^c Cost, evidence, ease of fabrication in-house, comfort, and can be used to correct mild relapse.

^d Flat titanium, dead titanium, SS multistrand round, CAD-CAM titanium, and TM (titanium molybdenum) alloy wire.

Most participants reported the use of clear plastic retainers (91.1%), with these being fabricated exclusively in external laboratories for 43.7%, although in-house fabrication (37.3%) and a combination of external and inhouse fabrication (19%) were also prevalent (Table 3). More than two-thirds of participants reported that vacuum forming was the preferred manufacturing technique (69.6%). The thickness of clear retainer blanks commonly used was 1 mm (44.3%), with 0.75 mm being the next most commonly used thickness (20.9%). Over threequarters of respondents provided patients with only one set of clear retainers (79.1%). Only 37.3% were aware of the type of material used to fabricate their clear plastic retainers, which included mainly polyethylene terephthalate glycol (PET-G) (39%), polyurethane (17%), polypropylene (15.3%), polyester (8.5%), and polyvinylchloride (8.5%).

Two-thirds of participants typically prescribed FRs (75.7%), with four incisors (38.8%) or six anterior teeth (51.9%) usually being bonded in the maxilla and six anterior teeth being bonded in the mandible (91.5%) (Table 3). A range of popular wire designs were reported, including twisted ligature wires (22.3%), stainless steel (SS) multistrand (flattened) (19.2%), and SS retainer chain (17.7%). Almost two-thirds of respondents (64.6%) were unaware of the dimensions of the FRs used.

Frenectomy prescription was dictated by the extent of frenal attachment observed clinically (71.3%) and radiographically (29.3%) (Table 4). Most respondents did not change their standard practice regarding the use of FRs in patients with midline diastema in terms of the number of teeth included. However, the most common FR type used in patients with midline diastema was SS multistrand (flattened) (20.7%), followed by twisted ligature wires (18%). Fewer also used chain-like designs, including FlexTech, in the presence of preexisting diastema than they did for general use (16% vs 22.3%).

Respondents commonly prescribed Hawley retainers (58.4%), followed by clear plastic retainers (43.6%), following nonsurgical maxillary expansion, with no modification to their standard protocol (Table 4). Clear plastic retainers were prescribed with palatal

Nature of Correction/	Quastiana	Options	Findings 9/
Malocclusion	Questions	Options	Findings, %
Midline diastema	When frenectomy is prescribed	All median diastema in the permanent dentition	10%
	(tick all that apply)	Based on the size of diastema	28%
		Based on family history	14%
		Extent of frenal attachment (radiographically assessed)	29.3%
		Extent of frenal attachment (clinically assessed)	71.3%
		In the presence of functional/hygiene issues	13.3%
		Very rarely	17.3%
		I never prescribe frenectomy	4%
		Other	4% ^b
	Change to the no. of teeth included in the FR	Yes	18.7% ^c
	following diastema closure?	No	81.3%
	Material used for maxillary FRs following midline diastema closure	SS single-strand round	5.3%
		SS single-strand rectangular	6.7%
		SS retainer chain	10.7%
		Gold retainer chain	5.3%
		Twisted ligature wires	18%
		SS coaxial	11.3%
		SS multistrand (rectangular)	8%
		SS multistrand (flattened)	20.7%
		Glass fiber-reinforced retainer	2.7%
		CAD-CAM NITI	2%
		Other	9.3% ^d
Maxillary	Retainer used following nonsurgical maxillary	Clear plastic retainer	43.6%
expansion	expansion (tick all that apply)	Hawley retainer	58.4%
		Wraparound retainer	8.1%
		FR	17.5%
	Modification to clear plastic retainer following	Luse a different plastic retainer material	7.9%
	nonsurgical maxillary expansion (tick all that apply)	Luse a wire-supported plastic retainer	3.2%
		Luse a plastic retainer with palatal coverage	23.8%
		I would not modify my standard protocol	63.5%
		Luse a thicker plastic retainer sheet	7.9%
Maxillary incisor	Betention protocol following the correction	CSE	25.4%
rotation	of significant maxillary incisor rotations	Clear plastic retainer	62.7%
rotation		Wranaround retainer	4.2%
	(lick all that apply)	FRe	76.8%
	When CSF is prescribed (tick all that apply)	Hawley retainer	9.0%
		All rotations $>90^{\circ}$	61 1%
		All rotations $> 45^{\circ}$	22.20/
		An rotations >45	11 10/
		Officential incisors only Other	F 60/ ^e
Antorior open hite	Approach to rotantian following the correction	Uner Hewley retainer	01.6%
Antenor open bite	Approach to retention following the correction	Clear plactic retainer	21.0%
	of an anterior open bite, in the maxillary arch (tick all that apply)		00.4 %
		FR Wroneround retainer	40%
			0.0%
	Approach to retention following the correction of an anterior open bite, in the mandibular arch (tick all that apply)	Hawley retainer	13.7%
		Clear plastic retainer	59%
		FR	61.2%
		Wraparound retainer	3.6%
	Approach to retention following the correction of an anterior open bite, by anterior extru- sion (tick all that apply)	Bond attachments on the incisors with anterior elastics	10.8%
		Extend FRs to include additional teeth	20.1%
		Leave habit-breaking appliance in situ during retention	27.3%
		No deviation from my standard protocol	53.2%
		Other	6.5% ^r
	Approach to retention following the correction of an anterior open bite, by posterior	Leave temporary anchorage devices in place for a period of time during retention	16.6%
	intrusion (tick all that apply)	Place posterior bite planes on clear plastic retainers	24.5%
		Place posterior bite planes on Hawley retainers	24.5%
		Use Hawley retainers with labial bow and buttons bonded to anterior teeth	2.2%

Table 4. Prescription of Retainers and Adjunctive Procedures Prescribed Depending on the Nature of the Correction/Malocclusion^a

Table 4. Continued.

Nature of Correction/	Quality	Orthog	
Malocclusion	Questions	Options	Findings, %
		No deviation from my standard protocol	51.8%
		Other	2.2% ^g
Deep-bite	Approach to retention in the maxillary arch	Hawley retainer	34.8%
correction	following the correction of deep bite (tick all that apply)	Clear plastic retainer	64.5%
		Wraparound retainer	7.3%
		FRs	29%
	Type of maxillary removable retainer integrat-	Hawley retainer	47.1%
	ing an anterior bite plane following correc-	Clear plastic retainer	30.4%
	tion of deep bite (tick all that apply)	No modification	29%
Poor interdigitation	Change to the retention protocol when	Fewer hours of wear of removable retainers	21.2%
	posterior interdigitation is limited	More likely to use FRs only	29.9%
	(tick all that apply)	More likely to use Hawley retainers	35%
		More likely to use a positioner	10.2%
		More likely to use wraparound retainers	15.3%
		No deviation from my standard protocol	15.3%
		Other	6.6% ^h
No retainers	% not prescribed retainers in the maxillary	Maxillary arch	
	and mandibular arches (with the exception	<1%	71.4%
	of hygiene or compliance issues)?	1–25%	14.3%
		Up to 50%	0%
		51–99%	9.5%
		100%	4.8%
		Mandibular arch	
		<1%	76.2%
		1–25%	19.1%
		Up to 50%	0%
		51–99%	4.8%
		100%	0%
	Cases in which retainers may be avoided	Following the correction of an anterior crossbite	52.4%
	(tick all that apply)	Good buccal interdigitation on debond	38.1%
		Mild pretreatment crowding	4.8%
		Other	19.1% ⁱ

^a FR indicates fixed retainer; CSF, circumferential supracrestal fiberotomy; and SS, stainless steel.

^b High relapse tendency, difficulty in space closure, and esthetic concerns.

^c 1-1, 2-2, 3-3, and extra chain on the centrals.

^d No retainer, CAD-CAM SS or titanium, SS multistrand round, dead flat, TM (titanium molybdenum) alloy, or does not use an FR.

^e Any degree of rotation.

^f Posterior bite plane (Hawley), overcorrection of the open bite, functional appliance at nighttime, tongue exercises, tongue spurs (habitbreaking reminders), and bonding attachments.

^g Spring-loaded bite plane.

^h FRs only, section Essix posteriorly, anterior bite planes, in-house aligners with vertical elastics, buttons and elastics, and allow for natural settling. ⁱ Absence of anterior crowding initially, crossbite correction in the mixed dentition stage, deep-bite cases (maxillary arch), avoid bonded retainers on the upper anteriors, and previous caries history.

coverage in less than one-quarter of these cases (23.8%).

Following the correction of significant maxillary incisor rotations, fixed retention (76.8%) and/or circumferential supracrestal fiberotomy (CSF) (25.4%) were commonly prescribed (Table 4). Participants were more likely to prescribe clear plastic retainers (62.7%) than Hawley retainers (9.9%) to retain derotated teeth. CSF was commonly prescribed for rotations greater than 90° (61.1%).

Maxillary and mandibular clear plastic retainers and/ or FRs were commonly prescribed in anterior open-bite cases (Table 4). Over half did not deviate from their standard protocol in these cases. Removable appliances, including clear plastic retainers (64.5%) or Hawley retainers (34.8%), were commonly prescribed following deep-bite correction, and respondents also commonly integrated anterior bite planes with the removable retainers following deep-bite correction (Table 4). Cases with poor interdigitation following orthodontic treatment were usually managed with the use of Hawley retainers (35%) and/or FRs (30%) (Table 4).

No retainer was rarely prescribed other than for patients who were either unwilling or unsuited to have retainers (Table 4). An exception was that no retainers were commonly prescribed following anterior crossbite correction (52.4%).

DISCUSSION

The present survey is the first to explore retention preferences based on the presenting malocclusion and treatment outcome and to evaluate the knowledge of orthodontists regarding the plethora of materials available. The findings highlighted that there is little tailoring of orthodontic retention and limited awareness of clear plastic retainer options and dimensions. Short durations of follow-up of patients in retention as well as the patchy adoption of monitoring software and mobile applications were also noted. The latter, in particular, may reflect the challenges associated with the uptake of newer technology within orthodontic offices.¹⁵

A preference for clear plastic retainers over other types of removable retainers was noted, most likely attributable to esthetics and patient experiences.¹⁶ The limited longevity of clear plastic retainers was a recognized drawback, however, with a mean life span of as little as 3.5 months being noted in one study.¹⁷ In the present study, the majority of participants expected these retainers to last up to 1 year. Previous gualitative studies highlighted that breakage and loss risk the termination of removable retainer wear.¹⁸ Notwithstanding this, only one set of retainers was typically provided, and most orthodontists did not schedule retainer review visits beyond 1 year into retention. Participants reported the nearly routine use of clear plastic retainers of 1-mm thickness, in line with previous research in which this was the most popular thickness in Canada,¹¹ Australia,¹³ and Ireland.¹² Previous research highlighted lower failure rates with 1-mm-thick than with 0.75-mm-thick clear plastic retainers over a 12-month period.¹⁹ Notwithstanding that, the effects of increasing the retainer thickness further have been the subject of limited assessments. In the current study, 63% of the participants were unaware of the type of material used. Of those who reported the material used, PET-G copolymer, followed by polypropylene, was the most common. In the current study, more than 40% of the respondents relied on dental technician preferences rather than clinical experience despite known differences in durability and the advent of tougher polymers, including polyurethane, which have been associated with lower fracture rates than PET-G copolymer-based clear retainers at 6 months of follow-up.²⁰

It has been reported that flexible spiral wires are associated with unwanted torque changes in the long term in up to 1% of cases.²¹ Chain-like retainer materials may be less likely to introduce these changes, although further research on this would be helpful.²² In addition, the use of computer-aided design and computer-aided manufacturing (CAD-CAM) designs was infrequent, perhaps related to high breakage rates and associated costs.²³ Evolving FR prescription rates were commonly reported, with 34.7% using more, and 24.2% using less, fixed retention than in the past. According to Pratt et al, 36% of orthodontists in the United States reported that their prescription of FRs increased in the last 5 years, compared to only 11% of orthodontists who reported that their prescription decreased.⁸ It is interesting to note that research findings were reported as being instrumental in accounting for both increased and reduced use. Previous research has alluded to the limited interaction with and understanding of orthodontic research,²⁴ likely explaining this discrepancy.

Fewer than one-third of the respondents referred to follow-up for more than 2 years after the completion of orthodontic treatment, and just over one-half dismissed patients within the first year. The 1-year follow-up duration may be favored due to the high proportion of detachments of FRs at the enamel-composite interface occurring within the first 6 months.^{23,25} Additionally, breakage of removable retainers is common in the first year; over half of thermoplastic retainers of a 0.75-mm thickness and Hawley retainers were fractured at 1 year of follow-up.²⁶ Nevertheless, it is accepted that retention requires long-term monitoring, and the delegation of the review of retention to general dentists may be problematic.^{11,13,27}

The use of fixed retention in cases with preexisting maxillary diastema is well established. The most common type of FR used by respondents to preserve midline diastema correction was SS multistrand wire (flattened) (20.7%), followed by twisted ligature wires (18%). In general, 17.7% of the respondents prescribed an SS retainer chain; however, this was reduced to 10.7% following the closure of midline diastema. This may have been due to the risk of stretching of passive chains leading to the reopening of space. A recent systematic review found that there was a dearth of research evaluating the effectiveness of frenectomy following the closure of midline diastema.⁶ In the current study, frenectomy prescription was dictated primarily by the extent of frenal attachment clinically (71.3%). It is therefore likely that functional and esthetic concerns may influence the decision to undertake frenectomy.

Following nonsurgical maxillary expansion, participants preferred the prescription of Hawley retainers over clear plastic retainers, with no modifications to their standard protocol. Regarding the use of clear plastic retainers, palatal coverage was rarely prescribed. In a recent randomized controlled trial, no difference in transverse stability was observed with 1-mm clear plastic retainers, including palatal coverage, compared to Hawley retainers.²⁸ Additionally, the relative impact of newer, tougher

polyurethane-based clear plastic retainers has not been assessed in clinical research. Up to one-quarter of respondents prescribed CSF, in keeping with previous research in Iraq²⁹ and Turkey.³⁰ A recent systematic review concluded that there was weak evidence supporting the prescription of CSF.⁶ As such, a discrepancy between research findings and clinical practice may again exist.

Following open-bite correction, clear plastic retainers were preferred over Hawley retainers. This may be attributable to the intrusion effect of clear plastic retainers.³¹ The use of fixed retention in these cases was particularly prevalent. While the benefit of fixed retention would appear intuitive in terms of overbite preservation, this has not been uniformly demonstrated in prospective research.³² Furthermore, modification to removable retainers with preferential posterior coverage can be considered to limit the risk of unwanted molar extrusion,⁵ although long-term evidence to support this practice is unavailable. Either way, almost one-quarter of the respondents reported the use of this approach following molar intrusion during treatment.

The findings of the current study were based on selfreported practice, which may be subject to recall bias. The prescription of different types of FRs and modification of removable retainers may also be influenced by the availability of materials and access to technical skills; however, the responses are likely to reflect real-world practice. A limitation of the current study included the relatively small sample size, which is a common issue associated with surveys in general. However, the sample size was considered sufficient to provide plausible results. Additionally, there was no evidence to suggest that the low response rate was associated with bias in relation to retainer prescription. In addition, while respondents were limited to those who were active on social media, a broad international cross-section, comprising those based in both private practice and university practice, was included.

CONCLUSIONS

- The findings highlight the surprising lack of tailoring of orthodontic retention regimes based on individual patient characteristics, relatively short follow-up of patients during retention, and limited application of remote monitoring software to augment in-person evaluation.
- The prescription of surgical adjunctive procedures was limited, although the use of CSF was common for severe rotations.
- Prospective research evaluating the effectiveness of nuanced approaches to retainer prescription based on the presenting malocclusion would be welcome.

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