Original Article

Patient perceptions and attitudes regarding post–orthodontic treatment changes

Nurver Karslı[a]; Irmak Ocak[b]; Burak Gülnar[c]; Tamer Tüzüner[d]; Simon J. Littlewood[e]

ABSTRACT

Objectives: To determine patient perceptions and attitudes regarding posttreatment changes at least 2 years after completion of orthodontic treatment.

Materials and Methods: A total of 125 patients (75 females, 50 males, aged 22.93 ± 2.98 years) were enrolled at least 2 years after debonding. Participants had either vacuum-formed retainers (VFRs) or bonded retainers (BRs). Posttreatment changes were evaluated digitally by comparing tooth positions at debonding and at least 2 years after debonding. A questionnaire was used to assess patient attitudes. Retainer usage, awareness of relapse, satisfaction with their current occlusion, and whether posttreatment changes were severe enough for them to consider retreatment were investigated.

Results: All patients showed some posttreatment changes in irregularity. Only 74% of patients wearing VFRs and 47.1% of patients wearing BRs were aware of posttreatment changes. Patients were more likely to notice posttreatment changes if there was an increase in mandibular irregularity of 1–3 mm. Awareness of posttreatment changes in the upper arch was higher in both groups. The majority of participants were satisfied with the results even if they noticed some minor posttreatment changes (VFR, 69.4%; BR, 76.5%). Dissatisfaction with posttreatment changes did not necessarily mean that a patient wanted retreatment.

Conclusions: A total of 26% of patients wearing VFRs and 52.9% of patients wearing BRs were unaware of posttreatment changes. Approximately half of the patients who noticed posttreatment changes were still satisfied with the result 2 years after debonding. Even patients dissatisfied with the effect of posttreatment changes do not necessarily want retreatment. (*Angle Orthod.* 2023;93:440–446.)

KEY WORDS: Retention; Posttreatment changes; Vacuum-formed retainer; Bonded retainer; Patient satisfaction; Satisfaction; Retreatment

INTRODUCTION

Posttreatment changes after orthodontic treatment are a recognized risk of treatment. These changes can be a true relapse or the return of the teeth to their pretreatment positions, or they can be a result of age changes, possibly attributed to late growth and changes in soft tissue pressures around the dentition.[1,2] Orthodontists try to mitigate against this by fitting retainers, but unwanted changes can still occur as a result of poor compliance with removable retainer wear, failed fixed retainers, or unwanted activity in fixed retainers while still in situ.[3]

Posttreatment changes are measured using a variety of approaches, including assessing irregularity in each arch using Little's Irregularity Index (LII) as well as changes in arch form, for example, intercanine and intermolar widths, and interarch relationships such as overjet and overbite.[4] Although there is no doubt that

[a] Assistant Professor, Department of Orthodontics, Faculty of Dentistry, Karadeniz Teknik University, Trabzon, Turkey.
[b] Assistant Professor, Department of Orthodontics, Faculty of Dentistry, Ankara Medipol University, Ankara, Turkey.
[c] Private Practice, Kayseri, Turkey.
[d] Professor, Department of Pedodontics, Faculty of Dentistry, Karadeniz Teknik University, Trabzon, Turkey.
[e] Consultant Orthodontist, Orthodontic Department, St Luke's Hospital, Bradford, UK.
Corresponding author: Dr Simon J. Littlewood, Orthodontic Department, St Luke's Hospital, Little Horton Lane, Bradford, BD5 0NA, UK
(e-mail: simonjlittlewood@aol.com)

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these changes are easily measured, what is less clear is whether these changes are relevant to patients, whether they notice these changes, whether they cause dissatisfaction, and whether they would prompt them to seek retreatment.

Previous research attempted to identify factors that may affect patient satisfaction with posttreatment changes. However, changes were artificially created on mandibular study models.[5]

It would therefore be interesting to explore patient perceptions to posttreatment changes that have occurred. The aims of this study were to determine patient perceptions of and attitudes to posttreatment changes.

The null hypotheses were the following:

1. Patients would not recognize posttreatment changes of increased irregularity of upper and lower teeth, overjet, or overbite change.
2. There would be no effect on patient satisfaction caused by an increase in the irregularity of upper teeth, increase in the irregularity of lower teeth, overjet change, or overbite change.
3. Patients would not be concerned enough to undergo retreatment if they noticed posttreatment changes in the irregularity of upper and lower teeth and changes of overjet and overbite.

MATERIALS AND METHODS

All patients in the orthodontic department who completed orthodontic treatment with a fixed appliance between 2018 and 2019 with digital scans available from debonding were invited to participate. The study received ethical approval by the Karadeniz Teknik University in May 2021 (2021/172), and informed consent was obtained from all participants.

Although patients were treated by multiple orthodontists, all were fitted with standard bonded retainers (BRs) or removable vacuum-formed retainers (VFRs). For the BR group, a 0.0195-inch flattened 6-coaxial stranded wire (Stranded Retention Wire, Ortho Classic Inc., McMinnville, Ore) was bonded directly lateral-to-lateral in the maxilla and canine-to-canine in the mandible. It was recommended to continue wearing the BR indefinitely. For patients in the VFR group, a set of alginate impressions was taken at the end of the debonding appointment, and a 0.40-inch VFR (Dentsply Raintree Essix, Sarasota, Fla, USA) was constructed in the laboratory and delivered on the same day. All patients were instructed to wear their retainers full-time for a year and then at night only for 6 months. After this, they were able to switch to alternate night wear. The same type of retention appliance was used in both arches in all patients.

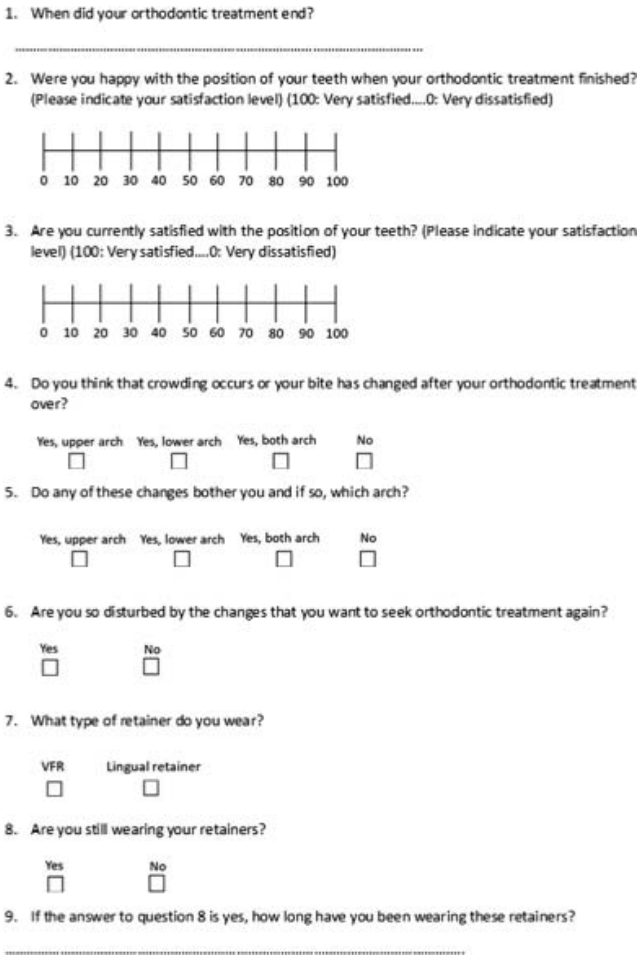


Figure 1. Questionnaire to measure patient perception.

The inclusion criteria were the following: (1) no craniofacial syndrome, (2) cervical vertebral maturation at cervical stage 5 or cervical stage 6, and (3) completion of treatment with only fixed appliance therapy.

The exclusion criteria were (1) no digital scan data after debonding, (2) any impacted or missing tooth at the start of treatment, (3) different retainers in the upper and lower arches, and (4) history of orthognathic surgery.

A questionnaire was designed to obtain information about the patients' experiences and opinions regarding the retention period. A pilot study was completed with a group of patients to check the intelligibility and answerability of the questions. The final questionnaire is shown in Figure 1. Dr Karslı accompanied patients as they answered the questionnaire to avoid problems with responsiveness.

The questionnaires determined whether:

1. Patients recognized relapse and, if so, which aspects of relapse they recognized.

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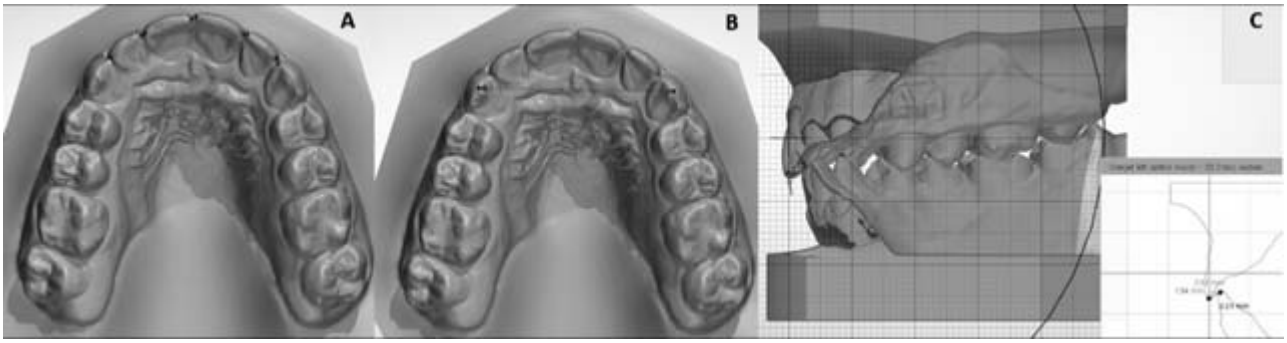


Figure 2. (A) Little's irregularity index. (B) Intercanine width. (C) Overjet and overbite.

2. Patients were satisfied with the teeth and, if not, which aspects of their relapse most concerned them.
3. Patients were concerned about their relapse enough to want retreatment.

Digital scans were used to assess posttreatment changes. For this, 3Shape Ortho Analyzer (3Shape A/S, Copenhagen, Denmark) software was used. Measurements were performed at two different time points: T1, immediately after debonding; and T2, at least 2 years after debonding (postretention). The following measurements were performed by the same author (Dr Karslı) (Figure 2):

- LII: the summed labiolingual displacement of the linear distances from one anatomical contact point to the adjacent contact point of the anterior teeth.
- Overbite: the mean vertical overlap of the maxillary to the mandibular central incisors.
- Overjet: the distance parallel to the occlusal plane from the incisal edge of the most labial maxillary central incisor to the most labial mandibular central incisor.

Three weeks later, the same author randomly selected 20 models and performed the measurements again to calculate the intraclass correlation to assess reproducibility and reliability. The intraclass correlation coefficient was in the range of 0.999–1.000, showing a high level of reproducibility.

Statistical Analysis

Statistical analyses were performed with SPSS for Windows 17.0 (SPSS Inc., Chicago, Ill). The normality of data was tested with Kolmogorov-Smirnov or Shapiro-Wilk tests when needed. Descriptive values were given as mean and standard deviations (for normal data), median and 95% confidence intervals (for nonparametric data), and percentages for categorical and nominal variables. Time-dependent changes were tested with the Wilcoxon signed-rank test. Chi-square tests were used for comparisons. The intraclass correlation coefficient was used to calculate the reproducibility and reliability. A P value less than .05 was considered statistically significant.

Multinomial logistic regression and binary logistic models were also used. To use the logistic regression, the variables were divided into distinct categories as follows:

- LII: 0–1 mm/1–3 mm/>3 mm
- Change in overjet (T2–T1): <1 mm/1–3 mm/>3 mm
- Change in overbite (T2–T1): <1 mm/1–3 mm/>3 mm
- Sex: male/female
- Age: 18–24 years (young adult)/25–35 years (older adult)

RESULTS

Total Number of Patients Included

A total of 143 individuals who completed orthodontic treatment between 2018 and 2019 were invited, and a total of 125 patients (85.4%), 75 females and 50 males, volunteered to participate in the research. The mean age was 22.93 ± 2.98 years, with a range of 18.25–34.50 years. Tables 1 and 2 show descriptive statistics in relation to retainer type; sex; and whether the patient was still complying with retainer wear, aware of posttreatment changes, dissatisfied with posttreatment changes, and so unhappy with the posttreatment changes that the patient would request retreatment.

Table 1. Age and Duration After Debonding of Patients According to Retainer Type[a]

	VFR	BR
Age, y, mean ± SD	23.0 ± 2.93	22.5 ± 3.34
Duration after debonding, y, mean ± SD	3.44 ± 1.20	2.82 ± 0.93

[a] BR indicates bonded retainer; SD, standard deviation; and VFR, vacuum-formed retainer.

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Table 2. Sex, Compliance With Retainer, Awareness of Posttreatment Changes, Dissatisfaction With Posttreatment Changes, and Request for Treatment Data According to Retainer Type[a]

	VFR (n = 108)		BR (n = 17)	
	n	%	n	%
Sex				
Female	63	58.3	12	70.6
Male	45	41.7	5	29.4
Continued retainer use				
Yes	37	34.3	10	58.8
No	71	65.7	7	41.2
Awareness of relapse				
Yes, upper arch	29	26.9	5	29.4
Yes, lower arch	21	19.4	1	5.9
Yes, both arches	30	27.8	2	11.8
No	28	25.9	9	52.9
Dissatisfaction from relapse				
Yes, upper arch	20	18.5	3	17.6
Yes, lower arch	6	5.6	1	5.9
Yes, both arches	7	6.5	0	0
No	75	69.4	13	76.5
Request for retreatment				
Yes	32	29.6	4	23.5
No	76	70.4	13	76.5

[a] BR indicates bonded retainer; VFR, vacuum-formed retainer.

Continued Use of Retainers More Than 2 Years After Debond

At 2 years after debond, 34.3% of the patients in the VFR group continued to use their retainers at night, whereas 58.8% of patients still had the BRs in place 2 years after debond (Table 2). The patients whose BRs had failed chose not to have them replaced, so they were left with no retainers. For the patients whose BRs failed, the average survival time was 5.1 months. It was not possible to know accurately at what stage patients who stopped wearing the removable retainers decided to stop wearing them.

Posttreatment Changes

All 125 patients showed some degree of posttreatment change as measured by changes in the irregularity of their upper and/or lower labial segments (Table 3). In the VFR group, there were statistically significant changes for all parameters (increase in LII of the maxilla and the mandible, overjet, and overbite). In the BR group, the LII of the maxilla increased statistically significantly.

Table 4. Distribution of Awareness vs Little's Irregularity Index

	Little's Irregularity Index, n (%)		
Awareness	<1 mm	1–3 mm	>3 mm
Yes, upper arch	4 (80)	13 (27)	17 (24)
Yes, lower arch	–	4 (8)	18 (25)
Yes, both arches	–	9 (19)	23 (32)
No	1 (20)	22 (46)	14 (19)

Awareness of Posttreatment Changes

A total of 74% of patients wearing VFRs and 47.1% of patients wearing BRs were aware of posttreatment changes (Tables 2 and 4). There was no statistically significant difference in the awareness of treatment changes between those patients who continued to wear their VFRs and those who had discontinued their use (Table 5). In contrast, those patients whose BRs failed were aware of the changes (Table 5).

Dissatisfaction With Posttreatment Changes

A total of 30.6% of patients wearing VFRs and 23.5% of patients wearing BRs were dissatisfied with the posttreatment changes (Tables 2 and 6). It was more common to be unhappy with changes in the upper arch than the lower arch. There was no difference in dissatisfaction with the posttreatment changes between those patients that were still wearing retainers and those who had discontinued their use (Table 7).

Request for Retreatment

A total of 29.6% of patients wearing VFRs and 23.5% of patients wearing BRs were dissatisfied

Table 3. Results of Dental Arch Measurements According to Retainer Type[a]

	VFR					BR				
	T1		T2			T1		T2		
	Median	95% CI	Median	95% CI	*P*	Median	95% CI	Median	95% CI	*P*
Maxillary LII	1.23	1.20–1.54	3.06	3.02–3.75	***	1.47	1.08–2.94	2.70	2.38–4.40	***
Maxillary intercanine width	34.99	34.54–35.22	34.15	33.82–34.53	***	35.06	33.67–35.25	34.15	33.66–34.99	
Mandibular LII	1.21	1.14–1.48	3.36	3.45–4.17	***	0.79	0.64–1.41	1.35	1.29–2.76	**
Mandibular intercanine width	26.59	26.36–26.92	25.80	25.33–25.86	***	25.93	25.23–26.67	25.61	24.76–26.38	**
Overjet	2.64	2.53–2.80	2.99	2.84–3.20	***	2.83	2.47–2.96	2.97	2.59–3.40	
Overbite	1.62	1.47–1.76	1.89	1.85–2.28	**	1.48	1.19–1.82	1.55	0.92–2.25	

[a] BR indicates bonded retainer; CI, confidence interval; LII, Little's Irregularity Index; T1, immediately after debonding; T2, at least 2 years after debonding (postretention); and VFR, vacuum-formed retainer.
* $P < .05$; ** $P < .01$; *** $P < .001$.

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Table 5. Effect of Retainer Type on Discontinued Use and Awareness of Changes[a]

	VFR			BR		
Awareness	Continued, n (%)	Discontinued, n (%)	*P*	Continued, n (%)	Discontinued, n (%)	*P*
Yes, upper arch	11 (29.7)	18 (25.4)	.167	2 (20)	3 (42.9)	.039*
Yes, lower arch	11 (29.7)	10 (14.1)		0 (0)	1 (14.3)	
Yes, both arches	8 (21.6)	22 (31)		0 (0)	2 (28.6)	
No	7 (18.9)	21 (29.6)		8 (80)	1 (14.3)	

[a] BR indicates bonded retainer; VFR, vacuum-formed retainer.
* $P < .05$, χ^2 test.

enough with their retainers to request retreatment (Tables 2 and 8).

Factors Affecting Awareness of Posttreatment Changes and Requests for Treatment

The only predictor for awareness of posttreatment changes using the regression model was a change in mandibular irregularity as measured by an increase in LII of 1–3 mm (Table 9).

Dissatisfaction with the result and an increase in overbite 1–3 mm were found to be predictors for patients requesting retreatment (Table 9). Neither age nor sex was found to be a predictor for awareness of posttreatment changes or request for retreatment.

DISCUSSION

Main Findings

All patients who fulfilled the inclusion criteria showed some degree of posttreatment changes 2 years after debonding, even with VFRs or BRs in place, as measured by LII. This showed that retainers could reduce but could not completely prevent posttreatment changes. The changes were larger in the patients wearing VFRs, with statistically significant changes in the LII in the maxilla and mandible in addition to statistically significant changes in overjet and overbite. This could have been because many of the patients with VFRs stopped wearing them. Interestingly, patients who were fitted with BRs only showed statistically significant posttreatment changes in the maxillary LII. Further long-term randomized controlled trials would be advisable to compare the effectiveness of BRs and VFRs.

Although all patients showed some degree of posttreatment changes, 26% of VFR patients and 52.9% of BR patients were unaware of these changes. This demonstrated that the measurements that orthodontists use to assess posttreatment changes are possibly more sensitive than what patients are actually aware of. On average, 1–3 mm increases in irregularity in the mandibular labial segment are required before patients become aware of posttreatment changes. Although the best predictor for awareness of change was an increase in mandibular irregularity, patients were more likely to be dissatisfied with changes in the upper arch. This suggested that patients are less likely to notice changes in the upper arch, but when they do, they are a cause for greater dissatisfaction. Neither age nor sex appeared to affect awareness of posttreatment changes or attitudes to retreatment.

Further investigation into patient satisfaction with their teeth position at least 2 years after debond showed that even if patients were aware of posttreatment changes, this did not necessarily mean that they were dissatisfied with the result. Only 30.6% of patients wearing VFRs and 23.5% of patients wearing BRs were dissatisfied with the posttreatment changes, despite a much higher percentage being aware of the changes.

One of the possible implications of patients being dissatisfied with their results is that they may wish to have retreatment. However, the results of this study showed that even if patients were dissatisfied with their results, only a minority disliked it enough to justify them seeking retreatment: only 29.6% of patients wearing VFRs and 23.5% of those patients wearing BRs said they would want retreatment. Presumably, the choice as to whether a further course of treatment is requested is also affected by other factors, such as willingness to undergo appliance treatment again, including the ability to fund this treatment. Certainly, dissatisfaction with treatment was identified as a possible predictive factor influencing the desire for more treatment. A change in overbite of 1–3 mm was also identified as a factor that may influence a request for retreatment, but it was not possible from this study to identify whether this was related to functional or esthetic reasons.

Table 6. Distribution of Request for Retreatment vs Satisfaction

	Satisfaction Level, n (%)				
Request for retreatment	0–20	21–40	41–60	61–80	81–100
Yes	–	6 (100)	7 (88.5)	13 (41)	10 (13)
No	1 (100)	–	1 (12.5)	19 (59)	68 (87)

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Table 7. Effect of Retainer Type on Discontinued Use and Dissatisfaction With Changes[a]

	VFR			BR		
Dissatisfaction	Continued, n (%)	Discontinued, n (%)	*P*[b]	Continued, n (%)	Discontinued, n (%)	*P*[b]
Yes, upper arch	7 (18.9)	13 (18.3)	.220	1 (10)	2 (28.6)	.245
Yes, lower arch	3 (8.1)	3 (4.2)		0 (0)	1 (14.3)	
Yes, both arches	0 (0)	7 (9.9)		0 (0)	0 (0)	
No	27 (73)	48 (67.6)		9 (90)	4 (57.1)	

[a] BR indicates bonded retainer; VFR, vacuum-formed retainer.
[b] χ^2 test.

How Do Findings Compare With Previous Research?

It was previously shown that orthodontists are more critical than general dentists and laypeople about the irregularity of teeth,[6–8] and this study showed that the measurements orthodontists use to assess posttreatment changes are more sensitive than what patients can notice.

Previous research demonstrated that patients were most likely to recognize significant horizontal movements of the lower incisors and least likely to notice rotational movements of mandibular incisors and the inclination of the lower canines[5]; however, this work was undertaken on study models with artificially created occlusal studies. In this real-life study, patients assessing their own posttreatment changes were more likely to notice changes in the mandibular irregularity index of 1–3 mm, so this study provides a valuable figure to gauge the average amount of relapse that is likely to concern a patient.

The desire to undergo retreatment is complex and is related to more factors than just the amount of posttreatment change, with previous qualitative research suggesting that financial considerations and treatment time also play an essential role.[5] In the same study on artificially created discrepancy on study models, the authors suggested that a horizontal discrepancy of greater than 5 mm between lower incisors would be a motivation for treatment, but this seems to be a rather extreme measurement to use. This study showed that patient dissatisfaction and a change in overbite of 1–3 mm were factors most likely to drive a request for retreatment.

Limitations of the Study

The study was based on all the patients who had completed fixed appliance treatment more than 2 years ago during the 2018–2019 time period. This was, by its nature, retrospective, so there may have been selection bias for patients who were prepared to come back to be part of the research.

The sample size may also not have been large enough to show a significant effect of predictive factors when using the regression analysis. However, the data for this study could be used to calculate appropriate sample sizes for future studies.

The feedback was based on a piloted questionnaire, which meant that the questions and topics asked were determined by the research team. An alternative approach would be to use focus groups or individual interviews using qualitative research.[9,10] The advantage of qualitative research is that it allows patients to present their own ideas, motivations, and opinions; addresses the power imbalance between researcher and patient; and recognizes that each patient has an individual approach to care.

Clinical Implications

This study demonstrated that, when taking into account patient perceptions of posttreatment changes, patients are likely to be considerably less critical than orthodontists. This in turn may lead to less dissatisfaction with posttreatment changes than might be expected, with patient tolerance to small changes being higher than may be predicted. Even if the patient is dissatisfied with the effects of posttreatment changes, this may not, on its own, lead to a request for retreatment, a decision that is likely influenced by other factors.

Table 8. Distribution of Request for Retreatment vs Dissatisfaction With Result

	Dissatisfaction, n (%)			
Request for retreatment	Yes, upper arch	Yes, lower arch	Yes, both arches	No
Yes	13 (56.5)	3 (43)	6 (86)	14 (16)
No	10 (43.5)	4 (57)	1 (14)	74 (84)

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Table 9. Regression Model Analyses

Dependent Variable	Predictor Factor	Data Coefficient, β	*P*	95% CI Lower–Upper Bound[a]
Awareness	Mandibular Little's Irregularity Index (1–3 mm)	0.249	**[b]	0.090–0.691
Retreatment	Satisfaction level	4.131	***[c]	2.251–7.582
Retreatment	Dissatisfaction (both maxilla and mandibula)	1.907	***[c]	1.381–2.633

[a] CI indicates confidence interval.
[b] Multinomial logistic regression.
[c] Binary logistic regression.
* $P < .05$; ** $P < .01$; *** $P < .001$.

Research Implications

The data collected here could be used to determine sample sizes for future studies identifying other factors that may affect patient perceptions of posttreatment changes. Further research in this area should include a qualitative research element that interviews patients who have been identified as having posttreatment changes.

CONCLUSIONS

- All patients in this study showed some degree of posttreatment changes, even when the patient had been provided with VFRs or BRs.
- A total of 26% of patients wearing VFRs and 52.9% of patients wearing BRs were unaware of posttreatment changes.
- Approximately half of the patients who noticed posttreatment changes were satisfied with the result 2 years later.
- Even patients who are dissatisfied with the effect of posttreatment changes do not necessarily want retreatment.

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REFERENCES

1. Melrose C, Millet DT. Toward a perspective on orthodontic retention? *Am J Orthod Dentofacial Orthop*. 1998;113:507–514.
2. Littlewood SJ, Russell JS, Spencer RS. Why do orthodontic cases relapse? *Ortho Update*. 2009;2:43–49.
3. Kucera J, Littlewood SJ, Marek I. Fixed retention: pitfalls and complications. *Brit Dent J*. 2021;230(11):703–716.
4. Forde K, Storey M, Littlewood SJ, Scott P, Luther F, Kang J. Bonded versus vacuum-formed retainers: a randomized controlled trial. Part 1: stability, retainer survival, and patient satisfaction outcomes after 12 months. *Eur J Orthod*. 2018; 40:387–398.
5. Kearney MK, Pandis N, Fleming PS. Mixed-methods assessment of perceptions of mandibular anterior malalignment for re-treatment. *Am J Orthod Dentofacial Orthop*. 2016;150:592–600.
6. Alqahtani N, Preston B, Guan G. Perception of dental professionals and lay persons to altered mandibular incisors crowding. *J World Fed Orthod*. 2012;1(2):e61–e65.
7. Kokich VO, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent*. 1999;11:311–324.
8. Ma W, Preston B, Asai Y, Guan H, Guan G. Perceptions of dental professionals and laypeople to altered maxillary incisor crowding. *Am J Orthod Dentofacial Orthop*. 2014;146:579–586.
9. Al-Moghrabi D, Colonio Salazar FB, Johai A, Fleming PS. Factors influencing adherence to vacuum-formed retainer wear: a qualitative study. *J Orthod*. 2019;46:212–219.
10. Frawley T, Parkin N, Kettle J, Longstaff S, Benson P. Young person's experiences of orthodontic retainers: a qualitative study. *J Orthod*. 2022;49(4):394–402.

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