

ORIGINAL ARTICLE

Correlation between patient satisfaction with the use of a removable retainer and compliance: a correlational study

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ABSTRACT

Introduction: Removable retainers are one of the devices used after active orthodontic treatment. Their use requires patient compliance with the prescribed wearing time; however, many patients remain non-compliant due to dissatisfaction with the removable retainer. This study aims to analyze the correlation between patient satisfaction with the use of a removable retainer and compliance. **Methods:** The research method used is correlational analysis. This study uses primary data collected through online questionnaires via Google Forms to patients of the Universitas Padjadjaran Dental Teaching Hospital (RSGM Universitas Padjadjaran), aged 18-45 years, who have undergone orthodontic treatment with fixed appliances followed by the use of removable retainers for 1-24 months. The total sample consists of 38 subjects. The data were analyzed using the Spearman correlation test.

Results: The correlation between patient satisfaction while using a removable retainer and compliance with its use resulted in a correlation coefficient of 0.447, with a significance value of 0.002 (p value < 0.05).

Conclusion: There is a moderately strong positive correlation between patient satisfaction with a removable retainer and patient compliance in wearing it.

KEYWORDS

Patient compliance, patient satisfaction, orthodontic retainers, removable, retainer

INTRODUCTION

Relapse is the condition in which teeth return their original position prior to orthodontic treatment.¹ Relapse can occur due to changes in the position of the periodontal ligament and gingival tissue as they adapt to the new tooth alignment, potentially causing the teeth to shift back over time.² Research by Vaida et al. in Romania, involving a sample of 711 patients, showed that 72 patients (10.13%) experienced relapse within 6 months after treatment, 41 patients (5.77%) after 12 months, only 19 patients (2.67%) after 24 months later³

Orthodontic treatment is considered successful when post-orthodontic retention treatment is implemented, as it plays an important role in maintaining tooth alignment after the orthodontic appliance is removed.^{4,5} Post-orthodontic retention was introduced in 1904, and its clinical importance has been emphasized since the 1980s to 1990s.⁶ Post-orthodontic treatment helps clinically stabilize treatment outcome by using retention appliances over a long period of time. Retention in post-orthodontic treatment is essential to prevent relapse and ensure optimal long-term treatment outcomes.⁴

One type of post-orthodontic treatment involves the use of removable retainers. The effectiveness of this treatment depends on patient compliance with the specified daily wear time (DWT).^{7,8} Post-orthodontic treatment is considered successful when the patient adheres to the prescribed wear schedule for removable retainers.⁹ Patients who follow instructions achieved maximum stability in post-treatment results. A study showed that patients who wore retainers regularly had

better tooth alignment even 10 years after completing orthodontic treatment, compared to those who did not wear any type of retainer.⁸ However, many patients remain non-compliant by not adhering to the recommended wear time and reducing the duration of use at will.⁷ This non-compliance is often due to difficulties in using removable retainers, such as trouble speaking during the first week of using and feeling of embarrassment about their appearance while wearing removable retainers.¹⁰

Previous studies on patient compliance with removable retainers use have shown that the majority of patients tend to shorten the prescribed daily wear time (DWT).^{7,11} Some studies indicates that patient compliance decreases as treatment progresses.^{12,13} Additionally, several studies suggest that age and gender influence compliance,^{9,13} while others report no significant effects of these factors.^{14,15} Research exploring the correlation between patient compliance and satisfaction with the use of removable retainers remains still limited.¹⁶

The only study addressing this correlation reported that elements of patient satisfaction- such as comfort, fit, and perception likability- are likely to influence whether patients consistently wear their retainers as instructed.¹² To date, no studies have examined the correlation between patient satisfaction compliance in the removable retainers use in Indonesia. This study aims to analyze the correlation between patient satisfaction while using a removable retainer and patient compliance.

METHODS

The research was conducted using correlational analysis design. Primary data were collected by distributing questionnaires to subjects who meet the inclusion criteria. The inclusion criteria were patients of RSGM Universitas Padjadjaran who had undergone orthodontic treatment with fixed appliances, followed by the use of removable retainer for a period of 1-24 months, aged 18-45 years, and willing to participate in the study. The exclusion criteria was patients who declined to complete the questionnaire.

The sample in this study consisted of patients from RSGM Universitas Padjadjaran, selected using a purposive sampling technique. The sample size was calculated using a correlational analytic formula, with a minimum requirement of 36 subjects. A total of 38 patients agreed to participate by signing the informed consent form.

The questionnaire for this study was developed using Google Forms and distributed online to the research subjects. It was adapted from an English-language questionnaire used in a previous study by Wild (2013) and translated into Bahasa Indonesia by a certified translator.¹² The questionnaire included two questions regarding the number of hours per week the removable retainers were worn, used to measure patient compliance, and five questions assessing patient satisfaction while using removable retainers.

Two additional questions were added to the satisfaction variable, bringing the total of seven. Each satisfaction question represented a specific dimension including comfort, fit, speech, appearance, liking of the retainer, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene. In this study the term "dimension" refers to the several branches in the satisfaction variable, used to differentiate the various elements being evaluated.¹²

The overall level of satisfaction in this study using seven questions on a Likert scale ranging from 1 to 5, where 1 indicating 'strongly disagree' and 5 indicating 'strongly agree' for each statement. The total satisfaction score was obtained by summing the values of the seven responses, resulting in a possible score range of 7-35. These total scores were then categorized into five groups: "very dissatisfied"

(7-12.6), "dissatisfied" (12.6-18.2), "neutral" (18.2-23.8), "satisfied" (23.8-29.4), and "very satisfied" (29.4-35).¹²

Compliance was measured based on the number of hours per week of each respondent wore their removable retainers. Respondents were categorized into two groups: the "non-compliant" group, if the weekly wear time was less than 56 hours, and the "compliant" group, if the wear time was 56 hours or more. The correlation between patient satisfaction while using removable retainers and compliance with the use of removable retainers was analyzed using the Spearman correlation test.¹⁷⁻¹⁹

The questionnaire used in this research was tested for validity and reliability with 30 subjects. The validity test showed r-values ranging from 0.658 to 0.935 with a significance value of 0.00, while the reliability test yielded an r-value of 0.874. These results indicate that the questionnaire is valid and reliable for use in this study.

RESULTS

This study, involving 38 subjects who met the inclusion criteria, yielded the following results.

Table 1. Distribution of study subjects based on age, gender, type of removable retainer, and period of removable retainer use

Characteristics	Frequency (n)	Percentage (%)
Age		
18 - 25 years	18	47,4
26 - 35 years	16	42,1
36 - 45 years	4	10,5
Gender		
Male	5	13,2
Female	33	86,8
Type		
Hawley's retainer	19	50
Vacuum-formed retainer	19	50
Period of removable retainer use		
1-3 Months	12	31,6
3-12 Months	19	50
> 1 Year	7	18,4

Table 1 shows the characteristics of the research subjects based on age, gender, type of removable retainer, and duration of retainer use. The distribution indicate that the majority of subjects were female, totaling 33 people (86.8%). Most subjects were aged between 18 and 25 years, totaling 18 individuals (47.4%). An equal number of subjects wore Hawley and vacuum-formed removable retainers, with 19 individuals in each group (50%). Regarding duration of use, the majority of subjects had worn removable retainers for 3 to 12 months, totaling 19 individuals (50%).

Measurement of patient satisfaction was conducted using questionnaire completed by the research subjects. The section of the questionnaire assessing satisfaction consisted of seven questions rated on a Likert scale ranging from 1 to 5, where 1 indicated strong disagreement value and 5 indicated strong agreement with the given statement. Each of the seven questions represented one dimension: comfort, fit, speech, appearance, liking of the retainer, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene. Each dimension could be analyzed individually to determine the level of satisfaction within that specific aspect.

Table 2. Distribution of research subjects' responses on patient satisfaction levels for each dimension of removable retainers use.

Dimensions of Satisfaction	Satisfaction Level	Frequency (n)	Percentage (%)
Comfort	Strongly disagree	0	0
	Disagree	6	15,7
	Neutral	14	36,8
	Agree	14	36,8
Fit	Strongly agree	4	10,5
	Strongly disagree	0	0
	Disagree	2	5,3
	Neutral	5	13,1
Speech	Agree	21	55,3
	Strongly agree	10	26,3
	Strongly disagree	0	0
	Disagree	7	18,4
Appearance	Neutral	11	29
	Agree	14	36,8
	Strongly agree	6	15,8
	Strongly disagree	0	0
Liking of removable retainers	Disagree	6	15,8
	Neutral	11	29
	Agree	16	42,1
	Strongly agree	5	13,1
Ease of maintaining oral hygiene	Strongly disagree	0	0
	Disagree	5	13,1
	Neutral	9	23,7
	Agree	18	47,4
Ease of maintaining retainer hygiene	Strongly agree	6	15,8
	Strongly disagree	1	2,6
	Disagree	6	15,8
	Neutral	12	31,6
Ease of maintaining retainer hygiene	Agree	15	39,5
	Strongly agree	4	10,5
	Strongly disagree	2	5,3
	Disagree	8	21,5
Ease of maintaining retainer hygiene	Neutral	9	23,7
	Agree	15	39,5
	Strongly agree	4	10,5

Table 2 presents the percentage of responses by research subjects' responses for each category within each satisfaction dimension. These percentages help identify the most frequently selected satisfaction level, which indicates the majority responses for each dimension. In the comfort dimension, the highest frequencies were found in the "neutral" and "agree" categories, each selected by 14 subjects (36.8%). In contrast, for the other six dimensions-fit, speech, appearance, liking of removable retainers, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene-the majority of subjects selected "agree". Specifically, 21 subjects (55,3%) selected 'agree' for the fit dimension; 14 (36.8%) for speech; 16 (42.1%) for appearance; 18 (47.4%) for liking of removable retainers; 15 (39.5%) for ease of maintaining oral hygiene; and 15 (39.5%) for ease of maintaining retainer hygiene.

The seven questions assessing satisfaction were used to calculate each respondent's total satisfaction score. This score was obtained by summing the individual questionnaire scores for each respondent, and then categorizing the results into five groups: "very dissatisfied" (7-12.6), "dissatisfied" (12.6-18.2), "neutral" (18.2-23.8), "satisfied" (23.8-29.4), and "very satisfied" (29.4-35).

Patient compliance in the use of removable retainers was assessed through a questionnaire completed by the research subjects. The compliance section consisted of two questions: the first asked how many days per week the subject wore the removable retainer, and the second asked how many hours per day it was worn. Patient compliance was calculated by multiplying the responses to these two questions, resulting in the total number of hours per week the retainer was worn.

Table 3. Distribution of overall satisfaction levels and compliance levels among study subjects

	Satisfaction/Compliance Level	Frequency (n)	Percentage (%)
Total satisfaction score	Very dissatisfied	0	0
	Not satisfied	3	7,9
	Neutral	11	29
	Satisfied	17	44,7
	Very satisfied	7	18,4
Compliance (Hours per Week Wearing Removable Retainers)	Non-compliant (0 - 55 hours/week)	16	42,1
	Compliant (56 -168 hours/week)	22	57,9

The resulting duration value was then categorized into two groups: "non-compliant" and "compliant". Subjects were categorized as "non-compliant" if they wore the removable retainer for less than 56 hours per week, and as "compliant" if they wore it for 56 hours or more per week.

Table 3 presents the percentage distribution for each compliance category in wearing removable retainers. The data show that the majority of research subjects were satisfied, and more than half were classified as compliant. This allows for further investigation into whether these two aspects are related.

Table 4 presents the correlation results between patient satisfaction across each dimension and compliance with the use of removable retainers. All dimensions showed a positive correlation with compliance, with correlation coefficients as follow: 0.429 for comfort, 0.409 for fit, 0.281 for speech, 0.368 for appearance, 0.322 for liking of the removable retainer, 0.279 for the ease of maintaining oral hygiene, and 0.185 for the ease of maintaining retainer hygiene.

Table 4. Correlation between patient satisfaction when using removable retainers and compliance with removable retainers use at RSGM Universitas Padjadjaran

	Spearman Correlation Coefficient						
	Patient Satisfaction with Removable Retainers						
	Comfort	Fit	Speech	Appearance	Liking of Removable Retainer	Ease of Maintaining Oral Hygiene	Total Satisfaction Score
Compliance (Hours per Week Wearing Removable Retainers)	0,429* (p=0,007)	0,409* (p=0,011)	0,281 (p=0,088)	0,368* (p=0,023)	0,322* (p=0,049)	0,279 (p=0,090)	0,185 (p=0,267)
							0,477* (p=0,002)

*Correlation is declared significant if $p < 0.05$

There are differences in significance values across the satisfaction dimensions. The dimensions of comfort, fit, appearance, and liking of removable retainers showed significant value of less than 5% ($p < 0.05$), indicating a statistically significant correlation with compliance. In contrast, the dimensions of speech, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene had significant values greater than 5% ($p > 0.05$), indicating no significant correlation with compliance. Among the satisfaction dimensions with significant correlation with compliance comfort and fit demonstrated moderate correlation strength, while appearance, and liking for retainers showed weak correlation strength with compliance in the use of removable retainers.

On the other hand, the dimensions of speech, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene demonstrated positive but statistically non-significant correlations with compliance ($p > 0.05$). This suggests that although patients reported some levels of satisfaction in these areas, these factors may have a limited impact on their compliance wearing removable retainers. For instance, the relatively low correlation for speech ($r=0.281$) may indicate that speech disturbances, though noted, are not a major significance to

compliance. Similarly, while ease of maintaining oral hygiene ($r=0.279$) and retainer hygiene ($r=0.185$) were viewed positively by some patients, they appear to play a lesser role in motivating consistent retainer use.

Table 4 shows the results of the correlation between the total patient satisfaction score when using removable retainers and compliance with their use. The results indicate a positive and statistically significant correlation, with a moderate strength of correlation. The correlation coefficient was 0.477, with a significance value of 0.002 (p value <0.05), indicating that higher patient satisfaction is associated with greater compliance in wearing removable retainers.

It is important to emphasize that, although a positive correlation was observed between patient satisfaction and compliance, this relationship does not imply causation. Given the cross-sectional nature of the data, it is not possible to determine whether higher satisfaction leads to better compliance or vice versa. Additionally, it is possible that patients who are inherently more compliant—due to other unmeasured factors—may report higher satisfaction simply because they have adapted more successfully to using the retainer.

This complexity and ambiguity in the relationship represents a limitation that should be considered when interpreting these results. Based on the results, orthodontists are encouraged to enhance patient satisfaction by providing clear retainer education, addressing discomfort or concerns early in the treatment process, and maintaining effective doctor-patient communication—all of which may contribute to improve long-term compliance.

DISCUSSION

Every individual who has undergone orthodontic treatment needs to use a retainer device to provide retention support to the tissues surrounding the teeth.⁴ Retention is essential to maintain the corrected tooth position after removal of the orthodontic appliance and to prevent relapse.^{4,5} To effectively prevent relapse, a prolonged period of retainer use is required.⁴ The success of using removable retainers in preventing relapse is largely determined by patient compliance in wearing removable retainers.^{7–9} A study by Wafaie et al. (2023) reported that some patients experienced difficulties in using removable retainers. These difficulties were related to the patient's attitude towards the device, with some reporting trouble speaking and feeling embarrassed while wearing the retainer.¹⁰

Measurement of patient satisfaction levels in this study using a questionnaire developed by Wild (2013), with additional satisfaction dimensions adapted from Sawhney's research questionnaire (2013).^{12,20,21} The purpose of measuring patient satisfaction was to evaluate satisfaction across individuals' dimensions, including comfort, fit, speech, appearance, liking of removable retainers, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene, as well as overall satisfaction. This measurement also aimed to examine the correlation between patient satisfaction and compliance in using removable retainers.

The results of patient satisfaction per dimension are presented in Table 2. The table shows that the majority of research subjects responded "neutral" and "agree" regarding comfort when using removable retainers. For the dimensions of fit, speech, appearance, liking of removable retainers, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene, most subjects responded "agree" to the items in each dimension. The results for overall satisfaction are shown in Table 3, which indicate that the majority of research subjects fall into the "satisfied" category.

These findings are consistent with the study by Sawhney (2013), which reported that most patients were satisfied with their removable retainers—77% of subjects were satisfied with maxillary removable retainers and 86% with mandibular removable retainers.²¹ However, these results differ from those of Forde et al. (2017), who noted that patient satisfaction is a complex field

influenced by multiple factors, and that satisfaction measurements can vary in significance and interpretation across studies.²²

Measurement of patient compliance in the use of removable retainers in this study was conducted using a questionnaire adapted from previous research by Wild (2013).^{12,23} The purpose of this measurement was to assess whether patients adhered to the recommended protocol for wearing removable retainers.⁷ Compliance was determined by calculating the total number of hours per week the retainer was worn, based on responses provided in the questionnaire.¹² Compliance could be determined based on the extent to which an individual followed the removable retainer wearing protocol recommended by the doctor.^{8,9}

Some studies suggested different options regarding the wearing protocol of removable retainers. The most commonly recommended protocols are a full-time wear protocol for the first 3-6 months followed by a part-time wear (about 8 hours per day), , or a part-time wear from the outset.^{3,23} Other studies have found no significant difference between full-time and part-time wear protocols, with part-time wear shown to be equally effective in preventing relapse.¹⁷⁻¹⁹ These findings support the assertion used in this study, which consider individuals who wear removable retainers for at least 8 hours per day (or 56 hours per week) as compliant.

The percentage of patient compliance in the use of removable retainers is presented in Table 3. Research subjects wore them for 56 hours or more per week were categorized as compliant, while those who wore them for less than 56 hours per week were categorized as non-compliant.

The table shows that the majority of research subjects were categorized as compliant in the use of removable retainers, with 57.9% classified as compliant and 42.1% as non-compliant". These results are supported by research conducted by Sawhney (2013), which reported that approximately 82-83% of patients at the Orthodontic Clinic of Western University, Canada, who used removable retainers, were categorized as compliant.²¹ Similarly, a study by Vaghdouti et al. (2019) also supported these findings, stating that overall compliance levels for both types removable retainers were high.²³

The correlation between patient satisfaction when using removable retainers and compliance with their use was previously studied by Wild (2013).¹² Another study also reported a relationship between patient satisfaction in using removable retainers.²⁴ In Wild's study, the correlation analysis began by examining each individual dimension of patient satisfaction in relation to patient compliance.¹²

The results of the correlation between patient satisfaction in each dimension and compliance with the use of removable retainers are presented in Table 4. All dimensions showed positive correlation with compliance, with a correlation coefficient as follows: 0.429 for the comfort dimension, 0.409 for fit, 0.281 for speech, 0.368 for appearance, 0.322 for liking of the removable retainer, 0.279 for ease of maintaining oral hygiene, and 0.185 for ease of maintaining retainer hygiene.

Each satisfaction dimension analyzed varying levels of significance. The dimensions of comfort, fit, appearance, and liking of removable retainer had significance values of less than 5% ($p < 0.05$), indicating statistically significant correlation with compliance. In contrast, the dimensions of speech, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene had significant values greater than 5% ($p > 0.05$), indicating non-significant correlation. The significant findings suggest that comfort and fit have a moderate correlation with compliance, while appearance and liking for removable retainers have a weak correlation. Meanwhile, the dimensions of speech, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene are not considered to have a meaningful correlation with compliance. These results differ from previous research by Wild J, which reported that all satisfaction dimensions had significant correlations with compliance, with the speech and appearance showing negative correlation.¹²

According to Table 4, the correlation between overall patient satisfaction when using removable retainers and compliance with their use yielded a correlation coefficient of 0.477, indicating a positive correlation of moderate strength. The significant value of the correlation test was 0.002, confirming that overall patient satisfaction is significantly associated with compliance in wearing removable retainers. These results are in line with previous research by Wild (2013), which also reported a positive and statistically significant correlation between patient satisfaction and compliance.¹²

To the best of the authors' knowledge, this is the first study in Indonesia to examine the correlation between patient satisfaction with removable retainers and compliance with their use. However, several limitations should be acknowledged. As a correlational study, this research cannot establish a causal relationship between satisfaction and compliance. While it may seem intuitive that dissatisfaction leads to poor compliance, it is equally possible that non-compliant patients report lower satisfaction due to accumulated frustration or discomfort over time. Additionally, the reliance on self-reported data introduces the possibility of recall bias, as participants may have overestimated their actual retainer wear time.

Compared to international studies, the results are consistent in highlighting overall patient satisfaction as a key factor influencing compliance. However, cultural or behavioral differences may influence satisfaction in specific dimensions. These findings suggest that improving patient satisfaction with removable retainers could lead to improved adherence, thereby supporting better long-term outcomes in orthodontic retention.

The relatively small sample size and the focus on a single location further limit the generalizability of the findings. These limitations may influence the interpretation and applicability of the results. Future studies involving larger, more diverse populations and incorporating objective measures of compliance are recommended to provide more comprehensive insights. Despite these limitations, the findings of this study offer valuable preliminary evidence and can serve as a foundation for future studies in this area.

CONCLUSION

Four out of seven dimensions of patient satisfaction-comfort, fit, appearance, and liking of removable retainers-showed a positive correlation with compliance, while speech, ease of maintaining oral hygiene, and ease of maintaining retainer hygiene did not demonstrate significant correlations. These findings suggest that increasing patient satisfaction in specific areas may be a practical strategy to support improved compliance and promote long-term success in post-orthodontic treatment.

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REFERENCES

1. Littlewood SJ, Kandasamy S, Huang G. Retention and relapse in clinical practice. *Aust Dent J*. 2017 Mar 1;62:51–7. <https://doi.org/10.1111/adj.12475>
2. Inchingolo F, Inchingolo AM, Ceci S, Carpentiere V, Garibaldi M, Riccaldo L, et al. Orthodontic Relapse after Fixed or Removable Retention Devices: A Systematic Review. *Applied Sciences* [Internet]. 2023 Oct 18;13(20):11442. <https://doi.org/10.3390/app132011442>
3. Vaida L, Todor BI, Lile IE, Mut AM, Mihaiu A, Todor L. Contention following the orthodontic treatment and prevalence of relapse. 2019;11(1):37–42. <https://doi.org/10.1093/ejo/cjz072>
4. Krämer A, Sjöström M, Apelthun C, Hallman M, Feldmann I. Post-treatment stability after 5 years of retention with vacuum-formed and bonded retainers—a randomized controlled trial. *Eur J Orthod*. 2023 Feb 10;45(1):68–78. <https://doi.org/10.1093/ejo/cjac043>
5. Krämer A, Sjöström M, Hallman M, Feldmann I. Vacuum-formed retainer versus bonded retainer for dental stabilization in the mandible—A randomized controlled trial. Part I: Retentive capacity 6 and 18 months after orthodontic treatment. *Eur J Orthod*. 2020 Oct 1;42(5):551–8. <https://doi.org/10.1093/ejo/cjz072>
6. Lasance SJ, Papageorgiou SN, Eliades T, Patcas R. Post-orthodontic retention: How much do people deciding on a future orthodontic treatment know and what do they expect? A questionnaire-based survey. *Eur J Orthod*. 2020 Feb 1;42(1):86–92. <https://doi.org/10.1093/ejo/cjz023>
7. Nahajowski M, Lis J, Sarul M. Orthodontic Compliance Assessment: A Systematic Review. *Int Dent J*. 2022 Oct 1;72(5):597–606. <https://doi.org/10.1016/j.identj.2022.07.004>
8. Quinzi V, Carli E, Mummolo A, De Benedictis F, Salvati SE, Mampieri G. Fixed and removable orthodontic retainers, effects on periodontal health compared: A systematic review. *J Oral Biol Craniofac Res*. 2023 Mar;13(2):337–46. <https://doi.org/10.1016/j.jobcr.2023.02.015>
9. Lim ME, Dhaliwal JS, Wahab SWHA, Rahman HA. A survey of patient compliance with removable orthodontic retainer wear in Brunei Darussalam. *BDJ Open*. 2023 Dec 1;9(1). <https://doi.org/10.1038/s41405-023-00138-8>
10. Wafaie K, Mohammed H, Xinrui W, Zhou J, El Sergani AM, Yiqiang Q. Compliance with retainer wear using audiovisual integration and reminder: a randomized clinical trial. *Sci Rep*. 2023 Dec 1;13(1). <https://doi.org/10.1038/s41598-023-35686-4>
11. Karslı N, Ocak I, Gülnar B, Tüzüner T, Littlewood SJ. Patient perceptions and attitudes regarding post-orthodontic treatment changes. *Angle Orthod*. 2023 Jul 1;93(4):440–6. <https://doi.org/10.2319/100222-677.1>
12. Wild J. Patient preference and compliance between Hawley retainers and vacuum-formed retainers following orthodontic treatment. [Internet]. University of Louisville; 2013. Available from: <http://ir.library.louisville.edu/etd/1570>
13. Al-Moghrabi D, Barber S, Fleming PS. Removable retention: enhancing adherence and the remit of shared decision-making. *Br Dent J*. 2021 Jun 1;230(11):765–9. <https://doi.org/10.1038/s41415-021-2951-x>
14. Mirzakouchaki B, Shirazi S, Sharghi R, Shirazi S. Assessment of factors affecting adolescent patients' compliance with Hawley and vacuum formed retainers. *Journal of Clinical and Diagnostic Research*. 2016 Jun 1;10(6):ZC24–7.
15. Kourakou M. Objective assessment of patients' compliance with thermoplastic vacuum-formed retainers following fixed appliance therapy. 2016. <https://doi.org/10.7860/JCDR/2016/18539.7897>
16. Knaup I, Schulte U, Bartz JR, Niederau C, Craveiro RB, Jäger A, et al. Post-treatment Stability in Orthodontic Retention with Twistflex Retainers—Do Patients Benefit from Additional Removable Retainers? *Clin Oral Investig*. 2022 Aug 1;26(8):5215–22. <https://doi.org/10.1007/s00784-022-04490-1>
17. Bahije L, Ennaji A, Benyahia H, Zaoui F. A systematic review of orthodontic retention systems: The verdict. *Int Orthod*. 2018 Sep;16(3):409–24. <https://doi.org/10.1016/j.ortho.2018.06.023>
18. Proffit WR, Fields H, Larson B, Sarver DM. Contemporary Orthodontics - E-Book: Contemporary Orthodontics - E-Book [Internet]. Elsevier Health Sciences; 2018. Available from: <https://books.google.co.id/books?id=A45nDwAAQBAJ>
19. Kaklamanos EG, Kourakou M, Kloukos D, Doulis I, Kavvadia S. Performance of clear vacuum-formed thermoplastic retainers depending on retention protocol: a systematic review. *Odontology*. 2017 Apr 1;105(2):237–47. <https://doi.org/10.1007/s10266-016-0254-5>
20. Chagas AS, Freitas KMS, Cançado RH, Valarelli FP, Canuto LFG, de Oliveira RCG, et al. Level of satisfaction in the use of the wraparound Hawley and thermoplastic maxillary retainers. *Angle Orthodontist*. 2020;90(1):63–8. <https://doi.org/10.2319/031319-197.1>
21. Sawhney B. Orthodontic Retainers: A Survey of Patient Compliance and Satisfaction. In 2013. Available from: <https://api.semanticscholar.org/CorpusID:56579237>
22. 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 Jul 27;40(4):387–98. <https://doi.org/10.1093/ejo/cjx058>
23. Vagdouti G, Karvouni E, Bitsanis E, Koletsis D. Objective evaluation of compliance after orthodontic treatment using Hawley or vacuum-formed retainers: A 2-center randomized controlled trial over a 3-month period. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2019 Dec 1;156(6):717–726.e2. <https://doi.org/10.1016/j.ajodo.2019.07.008>
24. Devi S, Jain RK, Balasubramaniam A. Comparative evaluation of patient satisfaction following the use of two different orthodontic removable retainers: A prospective randomized controlled trial. *Journal of International Oral Health*. 2022 Jul 1;14(4):370–6. https://doi.org/10.4103/JIOH.JIOH_17_22