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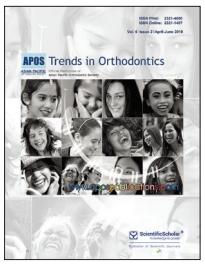

Original Article

Difference in acceptance and satisfaction perception on the use of Hawley and vacuum-formed retainers among post-orthodontic patients

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ABSTRACT

Objectives: It has been observed that using a retainer during the retention phase of orthodontic treatment can result in various patient perceptions; however, only limited research exists concerning it. Therefore, the present research studies and analyzes the differences in acceptance and satisfaction perception between patients who use two types of removable retainers: Hawley retainers (HRs) and vacuum-formed retainers (VFRs).

Material and Methods: This research comprised 80 participants (*n* per group = 40). Eligible individuals who had finished treatment between 6 months and 5-years-prior and met the inclusion criteria were contacted to partake in this study. The participants were asked to complete a digital-based questionnaire consisting of seven questions. Each patient was asked the questions twice, once for maxillary and once for mandibular retainers. The visual analog scale was used to measure their responses. Blinding was implemented to minimize potential bias during data analysis.

Results: Statistically significant differences were found in the speaking ability and positive comments received with maxillary retainer in place. Statistically significant differences were not found in the perception of adaptation, cleaning ability, negative comments received, and overall retainers' acceptance and patients' satisfaction with both retainers in place, as well as the speaking ability and positive comments received with the mandibular retainer. During the study, no harm was observed in any of the patients.

Conclusion: VFRs cause less speech difficulty and elicit more positive comments on the maxilla than HRs. No significant differences were found between HRs and VFRs concerning the perception of adaptation, cleaning ability, negative comments received, and overall retainers' acceptance and patients' satisfaction with both retainers in place. Moreover, no differences were found between patients' speaking ability and positive comments received with the mandibular retainer.

Keywords: Acceptance, Hawley retainer, Perception, Satisfaction, Vacuum-formed retainer

INTRODUCTION

The retention phase is the final step in orthodontic treatment, which aims to keep teeth in their newly achieved positions following treatment.[1] Several factors can cause teeth to shift back toward their initial malocclusion, leading to relapse.[2] The extent of relapse can vary significantly between individuals, making it challenging to predict.[2,3] Research on orthodontic treatments has found that 40–90% of patients experience changes in their teeth alignment 10–20 years post-debonding, indicating a high potential for relapse.[3-5] To maintain long-term stability and

prevent any changes in the long term, continuously wearing a retainer after orthodontic treatment is advocated.[4,6,7]

There are two retainer categories: Fixed and removable.[1] Hawley retainers (HRs), first mentioned in 1919, and a newer design named vacuum-formed retainers (VFRs) are the most commonly utilized removable ones.[8] Several studies have studied their effectiveness and have generally found either no noteworthy or only minor variations in their ability to maintain teeth positions.[9,10]

One significant weakness of removable appliances is patients' need to adhere to their retainer wear schedule.[11,12] Patients' compliance significantly affects the efficacy of orthodontic treatment, especially during the retention time.[11] Earlier research assessing treatment satisfaction has consistently highlighted patients' universally negative perceptions of retainers.[13,14] Retainer wear can pose a challenge in speech and mastication, increased saliva flow, social embarrassment, and overall inconvenience, surpassing those associated with fixed appliances and headgear.[14-16] Research indicates that many patients discontinue retainer usage within 2 years post-treatment.[17] Moreover, a majority either cease wearing their VFRs entirely or use them infrequently after 5 years.[18] The negative impact on patients' acceptance and compliance with their appliances is frequently caused by discomfort.[19] Nevertheless, few studies have evaluated patients' perceptions of retainer despite its crucial significance.[12,20] Many orthodontists recommend prolonged retainer usage, advocating for retention throughout patients' lives.[20]

Existing literature reviews indicate limited studies objectively assessing patients' perceptions of HRs and VFRs. One research focusing on cost-effectiveness and patient satisfaction within the initial 6 months post-debonding found a preference for VFRs among patients.[21] Another study reported that patients favored VFRs because they are aesthetically more pleasing and give better oral cavity comfort.[22] Nonetheless, both studies provided limited analysis of patient experiences with retainers, treating this aspect as secondary. It is pivotal to understand patient perspectives comprehensively; therefore, conducting thorough research is necessary.[7]

A comparative study assessed the acceptability of different types of retainers between two groups and reported that VFRs were preferred due to their ease of use while speaking.[12] A recent study comparing retainer use found similar satisfaction and preference between VFRs and HRs among one patient cohort.[8] Although agreement on the ideal duration of retention with retainers remains unreachable, experts in orthodontics advise wearing them for 12 months or more post-treatment.[7] The previous studies mentioned above have failed to compare patients' perceptions beyond 6 months. More recent research evaluated patient satisfaction to 5 years after debonding, reporting equal satisfaction levels between bonded retainers and VFRs; however, the study compared two different types of retainers.[18]

Considering the context mentioned earlier, conducting a thorough investigation of patients' perspectives on retainers is crucial. This research aims to gather information on patients' acceptance and satisfaction levels regarding retainers and to examine the differences in perception between patients who received HRs and VFRs within 6 months–5 years after their treatment.

MATERIAL AND METHODS

Research methodology and ethical approval

This study is a cross-sectional descriptive-analytic research study, which aims to assess the acceptance and satisfaction perception of patients using HRs and VFRs. Perceptions were evaluated through an online-based questionnaire. The study protocol received approval from the Dental Research Ethics Commission, Komite Etik Penelitian Kedokteran Gigi (KEPKG), Faculty of Dentistry, University of Indonesia (68/Ethical Approval/FKGUI/IX/2022).

Research setting and participants' criteria

The research was carried out in the Orthodontic Clinic, UI Dental Hospital and comprised all patients who had finished their orthodontic treatment. Patients were all treated by UI orthodontic residents.

Eligible patients who met the specified inclusion criteria were asked to join the research. These criteria included participants of both males and females aged 19–44 years old who wore fixed appliances on both arches during their orthodontic treatment at the Dental Hospital, had finished treatment for 6 months–5 years, using the same type of removable retainer either HRs or VFRs and be willing to complete an online digital-based questionnaire. In addition, participants were required to have a minimum of a high school education to ensure consistent cognitive and communication abilities for the research. The exclusion criteria were as follows: patients who did not meet these criteria or did not want to participate.

Calculation of the sample size

The present research utilized convenience sampling and simple randomization to select participants from the target population. A calculation of power was conducted as part of the assessment for another study (Part 1).[23] This calculation was predicated on a 5% alpha (α) significance level (0.05) and a 20% beta (0.02) to reach 80% power of the test (1-β), aiming to detect a minimum 1° difference in perceived acceptability and satisfaction (standard deviation = 0.78 from the prior study).[12]

The calculated sample size required 37 participants; to accommodate potential dropouts; and advance the study's

statistical power, 40 patients were enrolled per group, resulting in a total of 80 subjects. The subject selection did not differentiate based on gender.

Interventions

An online, closed, and digital questionnaire was utilized to evaluate perceptions of their retainers. An informed consent was collected from participants before beginning the questionnaire. Self-report questions that were previously used in other research were contained in the questionnaire, with additional modified questions tailored to this research.[12,20,21] The questions focused on perceived retainers' acceptance and satisfaction, with six questions asked twice for maxillary and mandibular retainers, resulting in 12 questions.

After each question, participants were presented with a 100mm visual analog scale (VAS). Respondents were asked to slide the VAS line's analog scale to give their response. The left tip of the line was given an excessively negative response, while the right tip was marked with a highly positive tone, consistent with the essence of the questions. The score length extended from "0" (least favorable) to "100" (most favorable). Before starting the questionnaire, written instructions were provided to all participants explaining the proper method for answering each question. The duration of completion for each participant was estimated to be within the range of 5–10 min. The questionnaires utilized in this research are listed in [Table 1].

Outcomes

The study evaluated patients' acceptability and satisfaction during the retention phase. A 12-question questionnaire with a 100-mm VAS was used to evaluate patients' perceptions. The responses were quantified in millimeters through digital measurement by measuring the length between the left tip and the slide of the scale.

Before collecting the data, a test was performed among other groups, using 10% of the total assessment sample size, to ensure the questionnaire was valid and reliable. In addition, this test assessed the time needed to finish the questionnaire.

Blinding

The primary examiner was blinded to the patient's characteristics and data to avoid potential bias during data analysis. Data analysis was conducted by appointing a personal ID per participant.

Statistical analysis

The validity of the questionnaire was evaluated using the Pearson Product Moment method, and its reliability was assessed using the inter-correlation coefficient (ICC) and Cronbach's alpha through a test-retest. The Shapiro-Wilk normality test ($n < 50$) assessed data distribution. An analysis was performed to identify the differences in perceptions. Since the data distribution was non-normal, non-parametric analyses used median and interquartile range. The Mann–Whitney test was utilized to compare responses from the questionnaire across various groups, and descriptive statistics were conducted to determine significant differences in perceptions between the groups. All statistical analyses were conducted using IBM Statistical Package for the Social Sciences (SPSS) 25.0 software (SPSS Inc., Chicago, Illinois, USA). The level of statistical significance was set at $P < 0.05$.

Table 1: A self-reported closed questionnaire regarding patients' acceptance and satisfaction while using the retainers.

Questions	VAS line end phrases	
	Left tip	Right tip
Acceptability		
1. Was it easy for you to adapt to the use of your retainer in the "upper jaw?"	Not easy at all	Very easy
2. Was it easy for you to adapt to the use of your retainer in the "lower jaw?"	Not easy at all	Very easy
3. Was it easy for you to speak while using your retainer in the "upper jaw?"	Not easy at all	Very easy
4. Was it easy for you to speak while using your retainer in the "lower jaw?"	Not easy at all	Very easy
5. Was it easy for you to clean your "upper jaw" retainer?	Not easy at all	Very easy
6. Was it easy for you to clean your "lower jaw" retainer?	Not easy at all	Very easy
7. Have you ever received any positive comments while using your retainer in "upper jaw?"	Never even once	Very often
8. Have you ever received any positive comments while using your retainer in "lower jaw?"	Never even once	Very often
9. Have you ever received any negative comments while using your retainer in "upper jaw?"	Never even once	Very often
10. Have you ever received any negative comments while using your retainer in "lower jaw?"	Never even once	Very often
Satisfaction		
11. Are you satisfied with retainer that was provided to you for use in "upper jaw?"	Not at all	Very satisfied
12. Are you satisfied with retainer that was provided to you for use in "lower jaw?"	Not at all	Very satisfied

VAS: Visual analog scale

RESULTS

Participants' recruitment and flow

Out of the initial group of 167 participants who met the specific criteria and were originally notified about this research (55 in HRs; 112 in VFRs), 63 opted not to participate, leaving a total of 104 patients (49 in HRs; 55 in VFRs) who agreed to participate in the research. Regrettably, 24 participants (9 in HRs; 15 in VFRs) could not complete the required questionnaires within the intervention period.

Participants' characteristics

The study included 80 participants (n = 40 per group). The mean age was 25.8 years for HRs, whereas the mean age of the VFRs was 28 years. Further, data for each group are shown in [Table 2].

Validity and reliability tests

The questionnaire's validity was evaluated using the Pearson Product Moment correlation coefficient. The r-table value was defined as 0.31. The calculated r-count was higher than the r-table, showing good questionnaire validity. The questionnaire's reliability test was carried out using a test-retest by collecting data from participants at two different times, with a 2-h gap between them. The analysis revealed a high intra-class correlation value (high ICC) of 0.0974 (confidence interval 95% of 0.913–0.992), suggesting that the questionnaire was reliable. These analyses confirm the questionnaire's reliability and validity.

RESULTS

VFRs group noted higher levels of acceptance and more effortless adaptation, better-speaking ability, and superior retainer cleaning for both arches. They also received more positive comments about their retainers than the HRs group. Conversely, the HRs group reported more negative comments when using their retainers. However, the study only found significant differences in the perception of speaking ability and positive comments received with the maxillary retainer in place ($P < 0.05$). There were no significant differences found between the groups in adaptation, cleaning ability, negative comments received with both retainers in place, and overall acceptance, as well as speaking ability and positive comments received with the mandibular retainer ($P \geq 0.05$) [Table 3].

Regardless of the group, all participants are more satisfied with the VFRs as their retainer. Statistically significant differences were not observed between groups concerning their satisfaction ($P \geq 0.05$) [Table 4].

Table 2: Characteristics of the study sample groups categorized by gender and age.

Sample Groups	*n*=	Gender		Age	
		Female (%)	Male (%)	Mean	Min-max
Hawley	40	30 (75)	10 (25)	25.8	19–39
VFR	40	34 (85)	6 (15)	28	19–43

VFR: Vacuum-formed retainer

Table 3: Mdn and IQR regarding the patients' acceptance of their retainer.

Perception	HRs	VFRs	*P*-value
	Mdn (IQR)	Mdn (IQR)	
Acceptability	45.25 (15.33)	56.60 (30.65)	0.254
Adapt (Mx)	70.00 (37.50)	74.00 (37.25)	0.335
Adapt (Mdb)	67.00 (50.00)	78.50 (38.75)	0.325
Speak (Mx)	40.50 (47.00)	70.00 (43.50)	**0.004**
Speak (Mdb)	48.50 (44.75)	70.00 (43.75)	0.062
Clean (Mx)	86.50 (25.00)	80.00 (47.00)	0.080
Clean (Mdb)	83.00 (25.00)	80.00 (46.25)	0.258
Positive comments (Mx)	15.00 (49.75)	39.50 (72.00)	**0.043**
Positive comments (Mdb)	17.50 (50.00)	29.50 (72.00)	0.069
Negative comments (Mx)	3.50 (20.00)	1.00 (10.00)	0.194
Negative comments (Mdb)	2.50 (13.50)	1.00 (11.50)	0.415

Statistical significance at $P<0.05$ is indicated in bold. HRs: Hawley retainer; VFRs: Vacuum-formed retainer; Mx: Maxillary retainer; Mdb: Mandibular retainer, Mdn: Median values, IQR: Interquartile ranges

Harms

Throughout the research, none of the patients reported any adverse effects or harm.

DISCUSSION

Main findings related to the previous studies

This study analyzed the perceptions of those who had completed their treatment with fixed appliances for 6 months–5 years, analyzing perceptions with the use of HRs and VFRs. Qualitative methods are crucial in evaluating patient satisfaction. Furthermore, its importance has grown recently, and as such, research and audits have incorporated techniques such as in-depth interviews, focus groups,

Table 4: Mdn and IQR regarding the patients' satisfaction with their retainer.

Perception	HRs	VFRs	*P*-value
	Mdn (IQR)	Mdn (IQR)	
Satisfaction	67.50 (31.88)	79.00 (32.25)	0.181
Satisfaction (Mx)	70.00 (37.50)	78.00 (35.25)	0.159
Satisfaction (Mdb)	66.50 (30.00)	79.00 (38.50)	0.164

HRs: Hawley retainer, VFRs: Vacuum-formed retainer, Mx: Maxillary retainer, Mdb: Mandibular retainer, Mdn: Median values, IQR: Interquartile ranges

and questionnaires.[24] The validity and reliability of the questionnaire were thoroughly assessed before the study, affirming its validity and reliability.

This study has found that with both retainers in place, the perception scores for adaptation and speaking ability of the HRs tend to be lower. Significant differences were only observed in the perception of speaking ability when using retainers in the maxilla. These findings are similar to outcomes reported in the previous studies, indicating that VFRs retainers are superior to HRs in enhancing speaking ability.[12] Various studies have also reported that even though using removable retainers may result in temporary speech articulation issues, using VFRs retainers is less likely to interfere with articulatory movements and does not significantly affect articulation.[25,26] After 7 days, the tongue adapts, and articulation distortion becomes insignificant.[12] In addition, it is noteworthy that VFRs retainers cover less material on the palatal area than HRs acrylic, leading to faster patient adaptation and improved comfort during retainer use. This finding is similar to the earlier study, which reported that reduced coverage of the palatal area results in less speaking difficulty and reduced patient discomfort during retainer use.[27]

Our research shows that the perception score regarding the ease of retainer cleaning in the HRs group is higher compared to the VFRs group; however, these differences did not reach any statistical significance [Table 3]. These findings align with previous studies, which concluded that maintaining oral hygiene with HRs is more manageable than with VFRs in the maxilla.[8] Another study suggested that patients in the VFRs group have better oral hygiene perception than those in the HRs group due to the transparent design of VFRs that enable patients to observe food residues and, thus, clean their devices better.[12] The difference in research outcomes indicates that the color and the design of the retainer do not affect the patient's ability to clean it. Continuous instruction on proper retainer cleaning techniques and patient motivation are more significant in maintaining retainer hygiene.[12] Maintaining oral hygiene while using a retainer is essential because it alters cavity conditions and microbiota. Biofilm formation affects overall health and the patient's oral cavity. Patients using VFRs are more susceptible to dental caries because retainer usage inhibits saliva flow on tooth surfaces and protects against bacteria. Plaque and calculus are also more likely to accumulate in the mandible compared to the maxilla.[22]

Respondents using VFRs more frequently received positive comments when using both retainers; significant differences were only found in the maxilla. HRs resulted in respondents receiving more negative comments when both retainers were used, which is believed to be closely related to the appliance design. However, this result is not statistically significant. The transparency of VFRs, which does not compromise esthetic appearance, is why respondents' social environments give more positive comments than HRs groups. This transparency makes respondents less embarrassed when using the retainer, thereby increasing confidence, and improving patients' speaking abilities when using the appliance.[12] Nearly invisible appliances have been linked to advanced attractiveness; their invisibility correlates with esthetic and social acceptance.[28] Using a more visible labial bow in the maxilla with HRs leads to more negative comments.[12,21,22]

This study found no significant difference regarding overall patients' acceptance of their retainer. These findings differ from previous studies stating that VFRs are more acceptable than HRs.[12,22] The previous studies assessed patients' perceptions solely within 6 months post-debonding. This study differed by extending the post-orthodontic treatment period to 5 years. A prolonged period permits patients to adjust to their appliances, which can reduce any initial discomfort. Comfort is crucial in ensuring patient compliance, so the factor retains significance as almost 30% of patients base their retainer selection on perceived comfort.[8,29] A notable interrelationship was observed between patients' comfort and compliance with the retainer wear schedule.[30] Furthermore, patient compliance is influenced by various factors, including post-treatment time.[31] This study suggested that the respondents had sufficient post-treatment adaptation time, which may have impacted their perceptions of the retainers used and ultimately affected the patient acceptance assessment outcomes.

This study found that participants in the VFRs group noted higher satisfaction levels than those in the HRs group. Although this difference did not achieve statistical significance, it was in line with findings from previous research that have found no significant difference in satisfaction with a retainer in place.[8] However, other studies have shown that patients preferred VFRs over HRs.[21,32] Wearing HRs caused more embarrassment than VFRs, which impacted respondents' satisfaction with the retainers.[21] The disparity in research outcomes compared to various previous studies supports the statement by Littlewood *et al*. (2016) that,

to date, there is insufficient evidence to assert that one type of removable retention device is superior to another regarding patient satisfaction.[7] The selection of appropriate removable retainers should be tailored and supported by assessing the relative benefits of all available retainer alternatives.[33]

Limitations

Recruiting participants for the HRs group proved challenging in this research due to the increased prevalence of VFRs. Moreover, as the entire study was carried out entirely online, conveying the significance of the research proved to be an obstacle. As a result, a significant disparity arose between the number of participants who finished the questionnaire and the initial outreach population. Technical limitations were also acknowledged as the drawbacks.

This study used the VAS method to evaluate patients' perceptions of retainer use and has proven to be an efficient tool for assessing subjective experiences related to treatment outcomes.[12,20,21] However, this method often produces varying outcomes, which makes it difficult to ensure consistent judgment across different participants. Achieving uniform judgment levels among diverse respondents requires a concerted effort.[34,35] A non-normal distribution of data can impact the collected results.

Generalizability

Several limitations impacted this research's scope, such as the choice of questionnaires and the retainers' types. Furthermore, even though the research involved patients who were a typical representation of patients who underwent orthodontic treatment, it is essential to note that the study group did not include individuals who received treatment with removable appliances. This limitation suggests that the findings cannot be applied to all individuals who undergo orthodontic treatment, especially those treated with removable appliances.

Implication for clinical practice

Earlier research has indicated that there are no significant variations in the effectiveness of HRs and VFRs.[9,10] This implies that when determining the most suitable retainer, the patient's clinical condition must be assessed before and after treatment. However, this study discovered that patients have distinct views about removable retainers; it is therefore essential to consider patient preferences when deciding about orthodontic care. Every situation should be evaluated, considering various factors that could impact their adherence to the retainer routine. To guarantee successful compliance, orthodontists should build a strong rapport with their patients, provide adequate support, consistently educate them on the regimen, and motivate them to comply. Furthermore, patients should be educated on the potential challenges they may face while using retainers over time. Adherence to the recommended wear schedule is crucial in preventing complications and relapse. Patients must comply with the prescribed treatment plan to ensure optimal outcomes.

Future research

Further studies related to retainers can be conducted using different research methods involving various types of retainers and addressing broader topics such as assessing patient compliance with retainers. In addition, studies from different subject perspectives and comprehensive research comparing patients' characteristics are necessary to investigate other factors influencing perceptions regarding retainers.

CONCLUSION

Participants experienced more difficulty in speaking and received fewer positive comments when wearing the HRs in the maxilla. However, there were no significant differences between the two groups concerning adaptation, cleaning ability, negative comments received, and overall retainers' acceptance and patients' satisfaction with both retainers in place.

Ethical approval

The research/study approved by the Institutional Review Board at Dental Research Ethics Commission (KEPKG), Faculty of Dentistry, University of Indonesia, number 68/Ethical Approval/FKGUI/IX/2022, dated September 22, 2022.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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