Patient compliance with orthodontic retainers in the postretention phase

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Introduction: Retention is an important, even critical, component of orthodontic treatment. There is little research on practice protocols and patient compliance with long-term or short-term retention. This lack of information leaves our specialty with many opinions and practice protocols. The purposes of this study were to evaluate and quantify orthodontic retainer wear according to several variables, including patient age, sex, time in retention, and retainer type, and to identify predictors of compliance and reasons for noncompliance with removable orthodontic retainers. Methods: Questionnaires were mailed to patients who finished full fixed appliance therapy in either the orthodontic graduate clinic or the orthodontic faculty practice at the University of Kentucky within the past 6 years. Of the 1085 questionnaires mailed, 280 were returned (25.8%). A logistic regression model that described the probabilities of retainer wear was created ($P < 0.0001$). Results: Patient compliance was greater with vacuum-formed retainers (VFRs) for the first 2 years after debonding. However, compliance with VFRs decreased at a much faster rate than with Hawley retainers. Because of this, patient compliance was greater with Hawley retainers at any time longer than 2 years after debonding, and patient compliance overall was greater with Hawley retainers. Conclusions: This evidence disagrees with the current anecdotal trend of orthodontists who favor switching from Hawley retainers to VFRs. An unexpected finding was that patients reported few esthetic concerns about retainers, and the few that were reported were equally distributed between Hawley retainers and VFRs. (Am J Orthod Dentofacial Orthop 2011;140:196-201)

The practice and the theory of orthodontic retention therapy have changed and continue to change over the years. It is currently believed that orthodontic patients should wear their retainers nightly throughout their life after treatment if they desire to maintain optimal dental alignment. Current beliefs are in contrast to the previous position that retainers need not be worn once remodeling of the surrounding periodontium is complete.

After orthodontic treatment, there are both a retention phase and a postretention phase of therapy. The retention phase consists of the time during which the periodontium remodels after the skeletal and dental changes associated with orthodontic treatment. The various components that constitute the periodontium complete this process over varying lengths of time. For example, reorganization of the periodontal ligament occurs over a 3- to 4-month period. The gingival collagen-fiber network takes 4 to 6 months to remodel, and the supracrestal fibers remain deviated for more than 232 days. It is generally accepted that the retention phase is completed within a year of finishing treatment.

The postretention phase of treatment continues for the remainder of the patient’s life. During this phase, movement of teeth can occur in response to changing forces in the periodontium caused by continued growth and development. Orthodontic retainers are worn during this phase to offset the effects of these changing forces. Practices regarding the frequency and length of time retainers should be worn during these posttreatment phases vary among orthodontists.

A considerable amount of research has been published about orthodontic relapse. Binda et al found that posttreatment changes were more pronounced in males than in females, and less pronounced in older patients. These authors also discovered that significant relapse occurs for at least 5 years after treatment. In a study of beagle dogs, van Leeuwen et al found that the duration of the retention phase was inversely correlated to the total amount of relapse. Moreover, the ability of retention to prevent relapse was also inversely...
correlated with the amount of tooth movement during treatment.

Because most orthodontic retainers are removable, patient compliance is an important factor in almost all cases. Many studies have focused on identifying personal characteristics strongly correlated with a compliant orthodontic patient. However, the data from much of this research have been contradictory, and other studies have yielded inconclusive results. Nanda and Kierl\(^6\) attempted to predict orthodontic cooperation with retainers by looking at attitudes toward treatment, social desirability, need for approval, and need for achievement. None of these variables proved to be a reliable predictor of compliance. Mehra et al\(^7\) found high self-esteem and self-confidence to be positively correlated with retainer compliance. In their study of factors associated with patient compliance with intraoral elastics and headgear wear, Egolf et al\(^8\) found the associated pain and inconvenience of those appliances to be inversely correlated with compliance. It stands to reason that this inverse relationship would apply to retainer wear as well.

Little research has been published regarding retainer compliance. A systematic review of orthodontic retention was completed by Littlewood et al\(^9\) in 2006. They concluded that there is insufficient evidence on which to base orthodontic retention practices. Kouguchi et al\(^10\) showed that 60% to 70% of patients and parents had forgotten the necessity of retainer wear after orthodontic treatment. A 2006 survey study of retainer compliance by Wong and Freer\(^11\) concluded that there was a strong relationship between retainer compliance and how comfortable the patient thought the retainer was to wear.

There have also been few published studies regarding retainer compliance with Hawley retainers vs vacuum-formed retainers (VFRs). Hichens et al\(^12\) in 2007 surveyed patient satisfaction with Hawley retainers and VFRs at 3- and 6-month posttreatment intervals. They found that patients in orthodontic retention experienced equal levels of discomfort regardless of the retainer type. Patients with VFRs reported an overall higher level of satisfaction and fewer breakages.\(^12\) In 1993, Stratton and Burkland\(^13\) reported that less acrylic coverage on the palate reduced speech difficulties and decreased gagging reflexes. This in turn led to increased patient comfort.

Many sources have confirmed a lack of evidence on orthodontic practice protocols and patient compliance with retention. This leaves our specialty with a multitude of opinions and practice protocols. The purposes of this study were to evaluate and quantify retainer compliance during the postretention phase according to several variables, including patient age, sex, time in retention, and retainer type. Our goal was to identify predictors of compliance and reasons for noncompliance.

**MATERIAL AND METHODS**

This study was conducted via a questionnaire that was mailed to patients who had finished full fixed appliance therapy in either the orthodontic graduate clinic or the orthodontic faculty practice at the University of Kentucky between 6 months and 6 years from the time the questionnaire was mailed. Patients who had been out of full fixed appliance therapy for less than 6 months were not surveyed because they were considered to be in the retention phase of treatment. The returned questionnaires did not identify the respondents. One thousand eighty-five patients were surveyed, ranging in age from 8 to 72 years. The questionnaire was sent twice to these patients, with the second mailing arriving 3 months after the first as a reminder to those who had not yet responded. The surveyed patients included those from both rural and urban environments with various socioeconomic backgrounds. The study was conducted between January and July 2008.

The questionnaires included several identifiers that allowed the respondents to be classified into subgroups. These identifiers included age, length of time since debonding, sex, and retainer type. In addition, each respondent was asked to identify how often he or she was instructed to wear the retainers, how often the retainers were actually worn, and any reasons for not wearing the retainers as instructed. This questionnaire is shown in Figure 1.

**RESULTS**

The first batch of questionnaires was mailed in January 2008, resulting in 185 completed and returned questionnaires. Three months later, a second copy of the questionnaire was sent with a reminder. The reminder yielded an additional 95 responses for a total of 280 (25.8%) questionnaires returned. Not everyone completed the entire questionnaire as instructed, so some data could not be classified into certain subgroups. For example, some respondents did not identify their sex.

A logistic regression model, which described the probabilities of retainer wear, was created based on the data. A likelihood ratio testing of model parameters was used to identify significant relationships (chi-square, 124.0485; df, 11 abbreviations). This logistic regression model found age, sex, amount of time out of braces, retainer type, and patient interpretation of proper retainer compliance to be statistically significant variables. There were interaction effects for 2 pairs of
these variables, leading to subtleties in the model interpretation. The Table describes retainer compliance based on this model. It shows the predicted proper retainer compliance at ages 15, 20, 30, and 40. It is broken down to identify differences in instructions, retainer types, times out of braces, and sexes. For example, the Table indicates that a 40-year-old man who understands that he should wear his retainers every night and has been in retention for 6 years with Hawley retainers has a 24% probability of demonstrating proper retainer compliance. However, the same patient with VFRs has only a 4% likelihood of proper retainer compliance.

Graphs were constructed to illustrate the reported reasons for poor compliance wear. These reasons were evaluated according to age and retainer type. Figure 2 gives reasons for noncompliance according to 3 age groups: under 18 years old, 18 to 35 years old, and over 35 years old. Figure 3 shows the reasons for noncompliance as a function of the types of retainers the patient had.

![The questionnaire.](image)

**Fig 1.** The questionnaire.
DISCUSSION

An important discovery in this study was the differing effect of time on retainer compliance based on the retainer type \((P = 0.0006)\). An analysis of the responses in this study suggests that patients were more compliant with VFRs than with Hawley retainers from the time they were debonded until approximately 2 years after debonding. This agrees with a study by Hichens et al who found that retainer compliance was greater with VFRs than with Hawley retainers at 3 and 6 months after debonding. However, we also found that retainer compliance with VFR retainers decreased at a much faster rate than with Hawley retainers. At approximately 2 years postdebonding, retainer compliance was equal in patients with Hawley retainers and VFRs. Because of the greater decrease in compliance over time with VFRs, the logistic model found that retainer compliance overall was greater with Hawley retainers. This long-term effect of time on retainer compliance with different types of removable retainers has never before been described in the literature.

One possible explanation for the faster decrease in retainer compliance with VFRs is differences in durability between the 2 retainer types. Because VFRs cover the occlusal surfaces, they tend to break down under the stresses of functional and parafunctional activities. For the most part, Hawley retainers do not cover the occlusal surfaces and are therefore less vulnerable to wear over time. Another factor that might influence compliance is the increased time required to maintain and clean a VFR. The wear and the flexibility of the VFR make it more susceptible to fractures, stains, and absorption of oral fluids.

One might think that the initially higher rate of compliance with VFRs could be explained by esthetic considerations. It stands to reason that if a patient is going to wear a retainer full time (as is done in the retention phase), he or she would be more likely to wear a clear retainer that is less conspicuous. However, this study did not support that speculation. Our data demonstrated that only 5% of the noncompliant subjects reported esthetics as the reason. Furthermore, the percentages of people who listed esthetic concerns as a reason for not wearing their retainers were equal for patients with Hawley retainers and VFRs. Therefore, the reason for greater compliance with VFRs after debonding has yet to be explained.

One issue that was not addressed in this study was the frequency of follow-up visits. The policy at the University

| Table. Logistic regression model predictions of patient compliance with VFR and Hawley retainers |

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| Patient reports being instructed to wear retainers every night |

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of Kentucky is to have several retainer checks during the first year after debonding. These visits typically occur at 6 weeks, 3 months, 6 months, and 1 year after debonding. After the first year, retainer checks typically occur annually. However, not all patients return for their retainer-check appointments. Retainer checks have several benefits, including reinforcing proper retainer wear, examining retainers for breakages and wear, evaluating the fit of the retainers, and identifying any other problems related to retention. In this study, we did not identify the frequency of the respondents’ retainer checks. It is likely that those who returned for these follow-up visits would be more likely to have proper retainer compliance.

Another factor that might affect our results was the high percentage of nonrespondents in this study. Although this model is a good indicator of how the above factors impact patient compliance with retainers, the model would most likely better represent the general population if there had been more respondents. It is reasonable to assume that nonrespondents were less compliant on average with orthodontic retainers than those who did respond. Therefore, the actual averages of retainer compliance are most likely lower than those reported here. It was not possible in this study to estimate the degree of difference if everyone who was surveyed had responded.

There seems to be a shift occurring among practicing orthodontists in the type of removable retainers they prescribe. Historically, the Hawley has been the favored retainer type, but recently the VFR seems to have gained favor. Fabrication of VFRs is less expensive and can be completed in-house in many practices. This study suggests that perhaps this shift in retention protocol should be reevaluated. However, this proposed shift in orthodontists’ retainer preferences is anecdotal. No published studies could be found to support or refute this observation.

Several other trends were identified in the logistic regression model. Female patients were more likely to wear their retainers than males ($P = 0.0022$). Younger patients were more likely to initially be complaint with retainer wear than older patients; however, as time out of braces increased, the compliance of younger patients decreased at a faster pace than that of older patients ($P = 0.0029$). Patients who understood proper retainer
compliance were more likely to be compliant than those who did not \( (P = 0.0001) \). Overall, compliance with retainer wear decreased as time out of braces increased \( (P < 0.0001) \).

A treatment recommendation based on the data from this study might be that improved patient compliance would result from initial use of a VFR, followed by the long-term prescription of a Hawley retainer. Timing for the change should be about 2 years and could approximately coincide with the transition between the retention and postretention phases. The results of this study also suggest that, although compliance is better with Hawley retainers than with VFRs, overall patient compliance with removable retainers is not acceptable, and fixed retention should be evaluated as a potentially preferred alternative to removable retainers.

**CONCLUSIONS**

The results of this study supported the following conclusions.

1. Patient compliance is greater with VFRs initially but, overall, is greater with Hawley retainers.
2. The following variables were significant determinants of patient compliance: the patient’s understanding of proper retainer compliance, the amount of time since debonding, the patient’s age, the patient’s sex, and the type of retainer.
3. Esthetic concerns were not a significant determinant of patient compliance.

**REFERENCES**