

# Assessment of Factors Affecting Adolescent Patients' Compliance with Hawley and Vacuum Formed Retainers

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## ABSTRACT

**Introduction:** Success of orthodontic retention with removable retainers almost entirely depends on patients' compliance.

**Aim:** This study was carried out to investigate the relationship between adolescent orthodontic patients' compliance and various clinical and social factors.

**Materials and Methods:** The data were collected from 77 orthodontic patients aged 7-11 years old who had finished the full fixed appliance therapy. Hawley's retainers were used in 34 patients and 43 patients used Vacuum Formed Retainers (VFRs). The subjects completed a questionnaire including several identifiers allowing the respondents to be classified into subgroups. They were also asked to indicate how long they wore their retainers during the day, by writing the number of hours in

the report-card for the next three months. Comparison of the results was performed by one-way ANOVA and independent sample-t tests.

**Results:** No significant differences were found between males and females. Type of the retainer, patients' grade of study, mothers' occupation, clinicians' and parents' attitudes and filling the report cards had significant effect on mean wear hours per day. When compliance of the patients was assessed according to treatment location, Living place, parents' educational degrees and ethnicity, no significant differences could be found.

**Conclusion:** The adolescent patients' compliance was greater with VFRs than with Hawley's retainers. Parental attitude and doctor-patient relationship had a great impact on adolescent patients' compliance.

**Keywords:** Orthodontic appliances, Patient cooperation, Questionnaires, Removable

## INTRODUCTION

Orthodontics requires patients' cooperation much more than the other areas of health care. Uncooperative patients are defined as having a defiant or poor attitude towards the orthodontic treatment [1]. Lack of cooperation or compliance can destroy the best treatment plan and the most promising treatment strategy [2].

The aim of orthodontic retention is to stabilize the position of the teeth after orthodontic treatment in optimal aesthetic and functional positions [2]. Various methods of retention are applied. However, their success almost entirely depends on the patient's compliance since most orthodontic retainers are removable [3].

Patients' overall compliance depends on such factors as socioeconomic and demographic factors, educational level, doctor-patient relationship, general information about treatment, family background, regimen and comfort, influence of the treatment provider and parental guidance [4-8]. Some studies have proved that parents have a determining and critical role in cooperation of their children [9-11]. Many studies have also focused on identifying personal characteristics strongly correlated with a compliant orthodontic patient. However, the data from much of these studies have been contradictory, and other studies have yielded inconclusive results [3,12].

Considering compliance in the retention phase, some studies found it associated with factors like age, gender, educational level, type of retainer, time since removal of the fixed appliance and parental influence [3,5,8,13,14]. Other studies reported no influence of these factors on patients' compliance [2,8,13].

There have been few studies regarding retainer compliance with Hawley's retainers compared to VFRs. Hichens et al., through the use of a questionnaire found that most people preferred VFRs over Hawley's retainers [15]. Kacer et al., noted that there is virtually

no difference in preference of retainer [13]. Pratt et al., concluded that patient's compliance is greater with VFRs initially but, in overall it is greater with Hawley's retainers [3]. Nevertheless, there is a controversy regarding the frequency and the length of time which retainers should be worn during the post treatment phase. Suggestions for removable retainer wear vary from night time only/part-time only to nearly 24 hours a day for the first six months after debonding [16-18].

The purpose of this study was to evaluate the potential association of adolescent patients' compliance with several demographic, clinical and social variables. Specifically, we took a broader approach to understand adolescent patients' compliance by focusing on a combination of child and parent factors along with clinical and social variables that might help to predict treatment compliance.

## MATERIALS AND METHODS

This cross-sectional study was carried out in the Department of Orthodontics at the Tabriz University of Medical Sciences and the first author's private practice from October 2013 to June 2015. The study design was independently reviewed and approved by the Committee for Research Ethics at the University (Ref Number: TBZMED.REC.428). An informed consent was obtained from parents or legal guardians, the patients gave written consent.

Considering 80% power, significance level of 5%, and 25% difference between wear times of Hawley's retainer and VFR groups, a sample size of 76 patients was needed for this study. The sample size was calculated using "Power and Sample Size" software (Version 3). However, 40 patients per each group (Hawley's retainer and VFR) were included to compensate for any lost to follow-ups [2,19,20].

**The inclusion criteria were:** Patients between 11 and 17 years of age who completed active orthodontic treatment with an indication for use of a removable retainer, no significant previous or concomitant organic or psychiatric disease, and check-up appointments at least every month and wear-time documentation of 90 days or more. The surveyed patients included those from both rural and urban environments and two different ethnicities. However, the socioeconomic status was different among the patients.

Participants and their accompanying parent were interviewed and trained by a member of the research team (orthodontist or student) in the waiting room, before their retainer was to be fit. In addition, they completed a questionnaire including several identifiers allowing the respondents to be classified into subgroups. A report-card (blank timetable) was given to patients. They were asked to indicate how long they wore their retainers during school hours, afternoons and nights by writing the number of hours (hours per each time) in the report-card for the next three months. They were also instructed how to wear and clean the device and were motivated intensively to regularly complete the timetable. The devices were made according to standard procedures in the Clinic of the Department of Orthodontics.

Each patient was prescribed to wear the removable retainer devices for 20 hours per day, corresponding to the references in the literature ranging between recommendations for night-time-only use and initial wear for nearly 24 hours a day. They were asked to adhere to the prescribed wear time from the first day of post treatment period and not to remove the appliances for drinking. They were informed that longer daily wear time is favourable because it can positively influence the outcome of the retention phase.

At regular check-up appointments, the same clinician evaluated the same patient every month for three months, and the filled report cards were obtained and another one was given. If the patient did not bring the report card, the parent was asked to return home to get it. At the third check-up appointment, each patient was requested to complete a patient satisfaction questionnaire while waiting to be seen by the researcher to check their retainers. It was designed to investigate the personal feelings and perceptions of the patients. The parent could assist if necessary. In addition, each respondent was asked to identify if their retainer was broken.

The influence of the following parameters on wear times was investigated: sex, patients' grade of study, retainer type; parents' ethnicity, educational degree and occupation; place of living (rural or urban), treatment location (university clinic or private orthodontic practice) and parents' and clinicians' attitudes.

## STATISTICAL ANALYSIS

The variables were described using mean and standard deviations (SD) and were checked for normality using the Kolmogorov-Smirnov test and Q-Q plot. Comparison of results was performed by independent sample-t test using SPSS 16.0 (IBM, Chicago, USA) at  $p < 0.05$  significance level.

## RESULTS

The data were collected from 77 orthodontic patients comprising of 38 males and 39 females, between 11 and 17 years of age who had finished the full fixed appliance therapy, from both private orthodontic office (n=37) and the graduate Clinic of the Department of Orthodontics (n=40) [Table/Fig-1]. Hawley's retainers [Table/Fig-2] were used in 34 patients, and VFR retainers [Table/Fig-3] were used in 43 patients. There were no significant differences regarding age and sex of the patients from the two locations ( $p > 0.05$ ). Three patients were excluded from the study during the treatment period because of moving to other cities.

	Male	Female	Age(y) $\pm$ SD	Maxilla	Mandible
Hawley's	18	16	14.04 $\pm$ 1.89	19	15
VFR	20	23	14.13 $\pm$ 1.81	26	16

[Table/Fig-1]: Sex distribution, mean age (years) and retainer type.



[Table/Fig-2]: Maxillary and mandibular Hawley's retainers.

[Table/Fig-3]: Maxillary and mandibular VFR retainers.

Parameter	n	Wear Time(h)		p-value
		Mean	SD	
<b>Sex</b>				
Female	39	15.9	6.5	0.22
Male	38	14.3	4.8	
<b>Age Group</b>				
Primary school	21	15.6	5.3	<0.001
Junior high school	34	17.3	4.5	
High school	22	11.7	5.4	
<b>Type of the Retainer</b>				
VFR	43	17.2	6.3	0.01
Hawley's	34	13.8	5.5	
<b>Who Trained the Patient</b>				
Orthodontist	41	16.9	5.1	<0.001
Student	36	12.6	4.2	
<b>Mother's Occupation</b>				
Housewife	42	16.9	5.6	<0.001
Clerk	35	12.8	3.5	
<b>Living Place</b>				
Rural	33	14.8	4.6	0.27
Urban	44	15.9	4.2	
<b>Treatment Location</b>				
University Clinic	40	14.8	5.3	0.22
Private Practice	37	16.4	6.1	

[Table/Fig-4]: Mean wear times in the first three months of the retention period for various parameters.

Regarding the association between compliance and gender, no significant difference was found ( $p > 0.05$ ). However, female patients were more likely to wear their retainers longer than males. There was a significant difference concerning patients' grade of study in daily averages of wear time ( $p < 0.001$ ). Junior high school children were the most compliant patients [Table/Fig-4].

Type of the retainer significantly affected mean wear hours per day ( $p = 0.01$ ), retainer wear time was significantly greater in VFRs. In addition, a total of 11 retainers were broken, of which eight were Hawley's retainers and three were VFR retainers. Filling the report cards proved to be effective on wearing the appliance during the day [Table/Fig-4].

There was a significant difference between groups trained by orthodontist and student in daily average of wear time ( $p < 0.001$ );

the patients who were trained by the orthodontist had a higher average of wearing the appliance. Mean hours of wearing retainers were significantly greater in patients with housewife mothers ( $p < 0.001$ ) [Table/Fig-4]. A meaningful relation was found between clinicians' and parents' attitudes and patients' daily average of wear time. According to the questionnaires, 43 patients indicated that their doctor's great attitude had positively influenced them. 39 patients had the same idea about their parents.

When the compliance of patients was assessed according to treatment location, living place and parents' educational degrees and ethnicity, no significant differences could be found ( $p > 0.05$ ). These parameters clinically, but not statistically, influenced the participants' compliance to a greater or lesser extent.

## DISCUSSION

Assessment of compliance for clinical or research purposes is difficult because of the wide variety of factors determining patients' compliance [21]. The use of a log (time table) for self-monitoring is common in medical practice. Past literature also suggests self-monitoring to be effective in dentistry [22-24]. Self-monitoring provides immediate feedback to the patients and reinforces the responsibility for performing the activity in adolescents [23].

The use of removable retainers means that the responsibility for retention lies with the patient. Compliance with removable retainer usage is out of the control of the orthodontist. This can lead to frustration for both practitioners and patients [2]. This study attempted to establish the relationship of adolescent orthodontic patients' compliance with various clinical and social parameters.

Findings about the influence of gender on appliance wear time are not consistent [3,5,8,12]. In the present study no statistically significant differences were found between females and males. However, female patients were more likely to wear their retainers longer than males, as was also observed in a study of patient compliance with Hawley's retainers and removable functional appliances by Schott et al., [2].

Allan and Hudson in a study on the use of personality measurements as a determinant of patient's cooperation in an orthodontic practice noted that the best co-operators were 14-year-old children [25]. This is similar to our results, which showed a greater compliance in junior high school children (between 13 to 15 years of age). A possible explanation for this finding is that these children might be more receptive and obedient to parental influence, and thus more responsive to instructions than older children [26]. However, further studies with larger sample sizes are needed in order to precisely explore the influence of age on patients' compliance.

An analysis of the data in this study suggests that the patients were more compliant with VFRs than with Hawley's retainers. A similar finding was reported by Pratt et al., who found that retainer compliance was greater with VFRs than with Hawley's retainers three months after debonding [3].

Asked directly, most study participants said that filling the report cards had positively influenced their compliance. This opinion agrees with the results of a previous study in which the patients who were asked to record the appliance wear on a calendar, wore their appliance significantly more than those patients who did not maintain a calendar [23]. One issue that was addressed in this study is the frequency of follow-up visits which typically occurred every four weeks. Follow-up visits make it possible to assess proper retainer wear, check for possible breakages and wear in retainers and evaluate their fit. Maintenance of the regular control and recall appointments is also identified as an important factor that affects compliance [27].

The relation between the person who had trained the patients and compliance was meaningful. Patients who were trained by

orthodontists had a higher average of wearing the retainer than those who were trained by students. Obviously orthodontists are more experienced than students and can provide more information with greater accuracy, thus improving the quality of care. In the same way, Pratt et al., noted that the patients who understood proper retainer compliance were more likely to be compliant than those who did not [3]. This finding is further supported by the study of Mehra et al., which indicated that educating the patient about proper use of the appliance is one of the effective methods to improve patient's compliance [4].

Sinha et al., noted that orthodontist positive attitudes resulted in an increase in the level of compliance by the patients [28]. Nanda and Kierl have shown that orthodontist-patient relationships have significant effects on patients' compliance [22]. Previous studies have also shown that parents' attitude have a strong influence on pre-adolescent and adolescent patients' cooperation levels during orthodontic treatment [4,9,29]. Research also has revealed that mother's influence is more instrumental to treatment motivation than a father's [30]. These findings compare very favourably with our results which confirm the important role of parents and clinicians on patients' compliance.

We are aware of only few studies which have evaluated the influence of treatment location and living place on patients' compliance [2,7,22]. This study showed a clinically better compliance for patients who were treated in a private practice compared with patients treated in the university clinic. Whether the family lived in a rural or urban setting had no significant effect on patients' compliance. Nevertheless, patients from urban families were slightly more compliant. Although statistical significance was not reached in our study population, possibly because of sample size, these are interesting and socially relevant variables worthy of further investigation.

Other variables including the ethnic background, the occupation and educational level attained by the parents were also investigated and did not yield any significant relationships except mothers' occupation which was identified as an important factor that affected patients' compliance. The paucity of the literature in this regard should be emphasized as well.

**Clinical significance:** Using removable retainers means that the responsibility for retention lies with the patient, therefore compliance with these retainers is out of the control of the orthodontist. This can lead to frustration for both practitioners and patients. The results revealed that adolescent patients' compliance is dependent on a combination of child and parent factors along with clinical and social variables.

## LIMITATION

Some limitations of this study should be mentioned. First, it used an indirect (self-report) method to measure the compliance. One might argue that subjective assessments of compliance, such as reports by patients, may not be reliable. Second, it was a cross-sectional study. Well-designed longitudinal studies, assessing the same patients at all stages of the treatment, would be more likely to provide greater detail for valid assessment and prediction of patients' compliance and a more comprehensive understanding of the dynamic interplay between various factors and compliance.

**Future Perspective:** In order to overcome these limitations, some electronic devices have been introduced and successfully used to objectively evaluate the level of patients' compliance [2,3,27,31,32]. It would be better to consider the use of electronic devices in orthodontic practice to measure wear-times of removable appliances. However, the main objective of the present study was to evaluate the relation between different factors and patients' cooperation rather than the objective measurement of the appliances' wear time.

## CONCLUSION

The results of this study supported the following conclusions: adolescent patients' compliance was greater with VFRs than with Hawley's retainers. Sex did not exert a significant influence on compliance. Parental attitude and doctor-patient relationship had a great impact on compliance in the adolescent orthodontic patients.

Although treatment compliance is a significant issue for orthodontists today, research in this area has been limited because of the lack of evidence on orthodontic practice protocols and standardized treatment compliance measures especially with retention and the limited focus of research by studying only patients who are in treatment. This leaves our specialty with a multitude of opinions and practice protocols. Literature on orthodontic retention suggests that there is insufficient evidence on which to base orthodontic retention practices. However, even though the surveyed factors in the present study cannot be regarded as the only factors to predict compliance, they can be still part of a combination of other factors which affect patients' cooperation.

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## REFERENCES

- [1] Gross AM, Samson G, Dierkes M. Patient cooperation in treatment with removable appliances: a model of patient noncompliance with treatment implications. *Am J Orthod.* 1985;87(5):392-97.
- [2] Schott TC, Schlipf C, Glasl B, Schwarzer CL, Weber J, Ludwig B. Quantification of patient compliance with Hawley's retainers and removable functional appliances during the retention phase. *Am J Orthod Dentofacial Orthop.* 2013; 144(4):533-40.
- [3] Pratt MC, Kluemper GT, Lindstrom AF. Patient compliance with orthodontic retainers in the post-retention phase. *Am J Orthod Dentofacial Orthop.* 2011; 140(2):196-201.
- [4] Mehra T, Nanda RS, Sinha PK. Orthodontists' assessment and management of patient compliance. *Angle Orthod.* 1998;68(2):115-22.
- [5] Amado J, Sierra AM, Gallón A, Alvarez C, Baccetti T. Relationship between personality traits and cooperation of adolescent orthodontic patients. *Angle Orthod.* 2008;78(4):688-91.
- [6] Brattstrom V, Ingelsson M, Aberg E. Treatment cooperation in orthodontic patients. *Br J Orthod.* 199; 8(1):37-42.
- [7] Tervonen MM, Pirttiniemi P, Lahti S. Development of a measure for orthodontists to evaluate patient compliance. *Am J Orthod Dentofacial Orthop.* 2011; 139(6):791-96.
- [8] Pauls A, Nienkemper M, Panayotidis A, Wilmes B, Drescher D. Effects of wear time recording on the patient's compliance. *Angle Orthod.* 2013; 83(6):1002-08.
- [9] Pratelli P, Gelbier S, Gibbons DE. Parental perception and attitudes on orthodontic care. *Br J Orthod.* 1998; 25(1):41-46.
- [10] Lewit D W, Virolainen K. Conformity and independence in adolescents' motivation for orthodontic treatment. *Child Dev.* 1968; 39(4):1188-200.
- [11] Witt E, Bartsch A, Sahn G, Schneider S. The determinants of wear behavior in treatment with removable orthodontic appliance. *Fortschr Kieferorthop.* 1992; 53(6):322-29.
- [12] Bos A, Hoogstraten J, Prah-Andersen B. On the use of personality characteristics in predicting compliance in orthodontic practice. *Am J Orthod Dentofacial Orthop.* 2003;123(5):568-70.
- [13] Kacer KA, Valiathan M, Narendran S, Hans MG. Retainer wear and compliance in the first 2 years after active orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 2010; 138(5):592-98.
- [14] Vig KW. Patient compliance to wear orthodontic retainers during postretention may vary by age, gender, and time since braces were removed. *J Evid Based Dent Pract.* 2012; 12:35-36.
- [15] Hichens L, Rowland H, Williams A, Hollinghurst S, Ewings P, Clark S, et al. Cost-effectiveness and patient satisfaction: Hawley and vacuum-formed retainers. *Eur J Orthod.* 2007; 29(4):372-78.
- [16] Gill DS, Naini FB, Jones A, Tredwin CJ. Part-time versus full-time retainer wear following fixed appliance therapy: a randomized prospective controlled trial. *World J Orthod.* 2007; 8(3):300-06.
- [17] Shawesh M, Bhatti B, Usmani T, Mandall N. Hawley retainers full- or part-time? A randomized clinical trial. *Eur J Orthod.* 2010; 32(2):165-70.
- [18] Valiathan M, Hughes E. Results of a survey-based study to identify the most common retention practices in the United States. *Am J Orthod Dentofacial Orthop.* 2010; 137(2):170-77.
- [19] Mirzakouchaki B, Shirazi S, Sharghi R, Shirazi S, Moghimi M, Shahrbaf S. Shear bond strength and debonding characteristics of metal and ceramic brackets bonded with conventional acid-etch and self-etch primer systems: an in-vivo study. *J Clin Exp Dent.* 2016; 8(1):e38-43.
- [20] Shirazi S, Kachoei M, Shahvagher Asl N, Shirazi S, Sharghi R. Arch width changes in patients with Class II division 1 malocclusion treated with maxillary first premolar extraction and non-extraction method. *J Clin Exp Dent.* (2016). doi: 10.4317/jced.52840.
- [21] Lee SJ, Ahn SJ, Kim TW. Patient compliance and locus of control in orthodontic treatment: a prospective study. *Am J Orthod Dentofacial Orthop.* 2008; 133:354-58.
- [22] Nanda RS, Kierl MJ. Prediction of cooperation in orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 1992; 102:15-21.
- [23] Cureton SL, Regennitter FJ, Yancey JM. The role of the headgear calendar in headgear compliance. *Am J Orthod Dentofacial Orthop.* 1993; 104(4):387-94.
- [24] Lin F, Sun H, Ni Z, Zheng M, Yao L. A feasible method to improve adherence of Hawley retainer in adolescent orthodontic patients: a randomized controlled trial. *Patient Prefer Adherence.* 2015; 9:1525-530.
- [25] Allan TK, Hodgson EW. The use of personality measurements as a determinant of patient cooperation in an orthodontic practice. *Am J Orthod.* 1968; 54(6):433-40.
- [26] Bos A, Kleverlaan CJ, Hoogstraten J, Prah-Andersen B, Kuitert R. Comparing subjective and objective measures of headgear compliance. *Am J Orthod Dentofacial Orthop.* 2007;132(6):801-05.
- [27] Tsomos G, Ludwig B, Grossen J, Pazera P, Gkantidis N. Objective assessment of patient compliance with removable orthodontic appliances. A cross-sectional cohort study. *Angle Orthod.* 2014; 84(1):56-61.
- [28] Sinha PK, Nanda RS, McNeil DW. Perceived orthodontist behaviours that predict patient satisfaction, orthodontist-patient relationship, and patient adherence in orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 1996; 110(4):370-77.
- [29] Albino JE, Lawrence SD, Lopes CE, Nash LB, Tedesco LA. Cooperation of adolescents in orthodontic treatment. *J Behav Med.* 1991; 14(1):53-70.
- [30] Daniels AS, Seacat JD, Inglehart MR. Orthodontic treatment motivation and cooperation: a cross-sectional analysis of adolescent patients' and parents' responses. *Am J Orthod Dentofacial Orthop.* 2009; 136(6):780-87.
- [31] Hyun P, Preston CB, Al-Jewair TS, Park-Hyun E, Tabbaa S. Patient compliance with Hawley retainers fitted with the SMART® sensor: a prospective clinical pilot study. *Angle Orthod.* 2015; 85(2):263-69.
- [32] Schott TC, Ludwig B. Quantification of wear-time adherence of removable appliances in young orthodontic patients in relation to their BMI: a preliminary study. *Patient Prefer Adherence.* 2014; 8:1587-595.

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