Factors Influencing Orthodontic Patient Compliance with Removable Retainers

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Abstract

Background: Maintaining the results of orthodontic therapy requires adherence to the use of removable retainers. However, compliance-related variables remain debatable. **Objective:** This study aimed to measure patient compliance in wearing a retainer and explore the factors that affect compliance. **Materials and methods:** Random sampling was conducted on 1,078 patients who had completed full-fixed appliance therapy from 2019 to 2022. The selected patients were stratified by the number of years (1 to 2, > 2 to 3, and > 3 to 4 years) after debonding. A telephone questionnaire consisted of four parts: patient characteristics, retainer utilization, knowledge, and attitude factors related to compliance. Descriptive statistics and binary logistic regression were used for the analysis. **Results:** There were 295 patients participating in this study. The response rate was 97 %. The percentage of compliance in wearing retainers for 1 to 2, > 2 to 3, and > 3 to 4 years after debonding were 64.30, 64.70, and 60, respectively. There were 5 factors significantly associated with patient compliance in wearing a removable retainer. Patients with scores of 8-10 in self-assessment of compliance had significantly more compliance than patients with scores of 0-7 (odds ratio = 20.40, 95 % CI 10.25-40.61). **Conclusion:** The percentage of compliance in wearing a retainer during four years after debonding was 63.10. Factors significantly associated with compliance in wearing a retainer were age, number of recall visits, loss of retainer, self-assessed level of compliance in wearing a retainer, and knowledge of the frequency of wearing a retainer.

Keywords: Compliance, Orthodontic, Retainer, Retention phase

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Introduction

A previous study reported that 72 % of orthodontic patients exhibited dental relationships that were outside of the ideal range.[1] Also, 40 % to 90 % of orthodontic patients had unacceptable dental alignment 10 years after retention.[2] Therefore, in order to achieve successful orthodontic treatment, it is imperative for patients to consistently use a retainer.

The posttreatment retention phase has a crucial role in preserving the alignment of teeth as the periodontal tissues undergo remodeling. Using a retention device also prevents change the natural process of occlusion aging, including the transitional changes in growth, dentoalveolar development, and muscular adaptation, all of which persist until adulthood.[2-4] Removable retainers are most commonly used as retention appliances. Consequently, patient cooperation and compliance are essential to realize good outcomes.[5]

There are numerous guidelines available regarding retainer usage. From 2003 to 2018, many studies attempted to compare different regimens for wearing a retainer. Wearing a retainer either part-time or full-time remains controversial.[6-9] Some studies reported that full-time wearing of a retainer has a better effect than part-time.[10,11] But one part of a systematic review in 2020[12] reported no statistically significant difference between part-time and full-time retainer use in either maxillary or mandibular arches. However, the retention protocol in terms of frequency nowadays tends to be more part-time. Similarly, the appropriate duration for wearing the retainer remains inconclusive. The best advice for patients is to continue wearing the retainer as long as it can be monitored on a regular basis by an orthodontist or a general practitioner or both.[3]

Compliance on the wearing of an orthodontic retainer has been reported. Kacer et al.[13] measured the cooperation of patients wearing a retainer based on remembering the orthodontist's instructions and following them. They found that the compliance rates in the periods of 0 to 3, 7 to 9, and 19 to 24 months were 69 %, 55 %, and 45 %, respectively. These results demonstrated a trend of decreasing cooperation in wearing the retainer as time passed but was not statistically significant. On the other hand, Pratt et al.[14] found that as time increased after debonding, the decrease in cooperation was statistically significant. In addition, Banabilh and Almuqbil[15] reported that 44 % of patients cooperated in wearing the retainers over a period of 4 months to 8 years after debonding, and a statistically significant difference existed in compliance levels that was related to the length of time following debonding.

Research into the factors affecting compliance in wearing a retainer revealed that certain variables did have an impact on compliance (amount of time out of braces,[14,15] parents' attitudes,[16] method of orthodontist instructions[17] etc.), while others had no effect (esthetic concern,[14] BMI,[18] treatment location, living place, parents' educational degrees, ethnicity[16] etc.) and still others produced inconclusive results (age,[13,14,19-21] gender,[13,14,16,19-22] type of retainer[13,14,16,20,23,24] etc.). Furthermore, little research seems to be available on the factors associated with patient compliance in wearing a retainer. Other interesting factors related to patient compliance in wearing an orthodontic retainer include the reason for requiring treatment, number of recall visits, knowledge and attitude of wearing an orthodontic retainer, access to service when the retainer had a problem, and patient self-assessment level of compliance. Therefore, the purposes of this study were to measure patient compliance and to explore the possible factors that affect compliance in wearing a retainer.

Materials and methods

Part 1: Questionnaire design and quality control

This project was approved by the Human Research Ethics Committee of the Faculty of Dentistry at Prince of Songkla University (EC6406-039). After reviewing the literature and conducting a pilot interview

in December 2022 with 18 patients who had completed fixed orthodontic appliance therapy, were able to communicate in Thai language, and were willing to voluntarily supply information.

To refine questions and assess reliability before gathering real data, a pilot telephone survey was conducted in December 2022, utilizing accidental sampling. Following the rule of thumb,[25] a minimum of 15 subjects per variable was advised, with 19 factors identified as relevant. Consequently, the sample population required at least 285 subjects. During data collection totally 295 were recruited.

The inclusion criteria were patients who had completed fixed appliance therapy at the Orthodontic Clinic, Faculty of Dentistry at Prince of Songkla University from 2019 to 2022 and had the debonding for at least one year. The exclusion criteria were patients with incomplete information, cleft lip/palate or syndromic patients, patients who received a fixed retainer, a dentist, a dental student, and patients who were not available by telephone.

The content validity of the telephone questionnaire with 19 factors of interest was tested by three orthodontists using the index of item-objective congruence (IOC). The IOC scores for each question ranged between 0.50 and 1.00, which were acceptable. Eleven items were revised and one item was deleted that ultimately became the complete questionnaire. All variables except attitude were assessed for reliability using the test-retest method, and the Kappa coefficient was used for analysis. The Cronbach's alpha coefficient was employed to assess the attitude for internal consistency in the first interview. The Kappa was 0.63-1.00 and the Cronbach's coefficient was 0.71, both of which were high values.[26,27] The questionnaire was attached in annex.

Part 2: Collecting data

Between January 2022 and April 2023, a cross-sectional study was conducted via telephone survey using a structured questionnaire. The sampling method employed was a disproportionate stratified random sampling, facilitated through https://www.random.org,

based on the year of brace removal. Patients were briefed on the study's invitation and particulars. Prior to the telephone interview, all participants provided verbal informed consent. Patients had the right to withdraw from research at any time. To prevent participants' identities from being revealed, all interview materials were anonymized. And the received information did not have any impact on future treatment.

In the event that the patient was not available for the interview at that time, the telephone interview will be rescheduled for a later date. If the researchers were unable to reach the patients via telephone more than twice, they were to attempt to contact the next randomly selected patient. When the patient reestablished communication and expressed consent to participate in the study, the researchers proceeded with the data collection and interview process.

The researcher (L) and a standardized research assistant (non-dentist) conducted 190 and 95 interviews, respectively. Approximately 20 to 30 minutes are required per person. The same interview approach was used throughout the process the desired sample size of 285 patients was achieved.

The following were the prescribed guidelines for assistant training: Firstly, the patients were interviewed by the researcher (L) until thorough interview methods were obtained. This training based on the recruited subjects. Secondly, the research assistant received training on interview methods, which included instructions on introducing themselves, requesting permission, and conducting the questionnaire in its entirety across all formats, along with a demonstration of data collection. Subsequently, engage in an understanding-gaining discussion with the research assistant. Lastly, the research assistant rehearses the interview and records findings only based on the patients' words. Afterwards, the research assistant was responsible for interviewing 95 patients.

Dependent and independent variables of the questionnaire

The complete questionnaire covered 19 factors of interest. The patient factors were age (at interview

date), gender, length of time since debonding, the number of recall visits to the orthodontist after starting use of a retainer, motivation for orthodontic treatment, reasons for receiving orthodontic treatment, and sponsorship of orthodontic treatment expenses.

The retainer usage factors were experience in losing or breaking the retainer, how the patient managed after losing or breaking the retainer, knowing the location of services for a new retainer, difficulties in traveling to dental service clinics for a new retainer, difficulty in obtaining a new retainer, the method of giving instructions by the orthodontist, and self-assessment level of compliance in wearing the retainer.

The knowledge factors included the retainer can maintain tooth position, the retainer must be worn every day, and the teeth may misalign if a retainer is not worn. The attitude factors were related to the importance of the retainer and possible tooth relapse.

The independent variables related to patient compliance in wearing the retainer were divided into two groups (Compliance and Noncompliance) as shown in Table 1.

Table 1 Dependent and independent variables

Dependent variables	Independent variables
Patient factors • Age • Gender • Length of time after debonding • Number of orthodontist recall visits after starting retainer use • Motivation for orthodontic treatment • Reasons for receiving orthodontic treatment • Sponsorship of orthodontic treatment expenses	**Compliance** Patients who have a retainer that properly holds the teeth and wear the retainer at least every night.
Retainer using factors • Experience in losing or breaking the retainer • How the patient managed after losing or breaking a retainer • Knowing the location of services for a new retainer • Difficulties in traveling to dental service clinics for a new retainer • Difficulty obtaining a new retainer • Method of orthodontist instructions • Self-assessment level of compliance in wearing the retainer	**Noncompliance** Patients who did not wear a retainer or wear a retainer less than every night, or used the retainer for reasons not related to orthodontic maintenance, such as using them to replace missing teeth.
Knowledge factors • Retainer can maintain tooth position • Retainer must be worn every day • Teeth may misalign if a retainer is not worn	
Attitude factors • Importance of the retainer • Tooth relapse	

Statistical analysis

Participant demographic data and compliance in wearing the retainer are presented as descriptive statistics. Binary logistic regression was used to analyze the statistics for factors affecting compliance in wearing the retainer using the SPSS software version IBM 29.0.0.0 (241). The level of significance (α) was set at $P < 0.05$. Detail of retrieving the effective rates was shown in Supplementary Table 4 (Available at https://kb.psu.ac.th/psukb/bitstream/2016/19405/1/Supplementary-Table-4.pdf)

Results

Initially, 697 patients were randomly selected from a total of 1,078 (which were the patients who had completed fixed appliance therapy at the Orthodontic Clinic, Faculty of Dentistry at Prince of Songkla University from 2019 to 2022). Then, 393 were excluded. Therefore, 304 patients were included in the study, but 9 patients refused to participate. Finally, 295 patients participated in this study for a response rate of 97 %. The demographic characteristics of the patients were summarized in Table 2. The percentages of school-age patients and working-age patients were 37.30 % and 62.70 %, respectively.

The compliance group consisted of 63.10 % of patients. The percentages of patients who wore the retainer every day and night and patients who wore the retainer every night were 13.60 % and 49.50 %, respectively. The noncompliant group consisted of 36.90 % of patients. The percentages of patients who wore the retainer on some days and patients who stopped wearing the retainer over a period of four years were 22 % and 14.60 %, respectively (Table 3).

Table 2 Frequency and percentages of the general characteristics (n = 295)

General characteristics	n (%)
Age (mean age 26.50 ± 8.60 years old)	
School-age (< 23 years old)	110 (37.30)
Working-age (≥ 23 years old)	185 (62.70)
Gender	
Male	75 (25.40)
Female	220 (74.60)
Length of time after debonding	
1 to 2 years	98 (33.20)
> 2 years to 3 years	97 (32.90)
> 3 years to 4 years	100 (33.90)
Number of recall visits	
0 time	175 (59.30)
1 time	79 (26.80)
2 times	26 (8.80)
≥ 3 times	15 (5.10)
Experience in losing or breaking a retainer	
Yes	83 (28.10)
No	212 (71.90)
Self-assessment level of compliance in wearing the retainer	
0-7	108 (36.60)
8-10	187 (63.40)

Table 3 Percentages of compliant and non-compliant respondents in wearing the retainers by length of time after debonding.

Length of time after debonding (years)	Assessments of compliance in wearing the retainer (n = 295)							Total
	Compliant (n (%)) (n = 186)			Non-compliant (n (%)) (n = 109)				
	Every day and night	Every night	Total	Some days	Not wearing	Other	Total	
1 to 2	20 (20.40)	43 (43.90)	63 (64.30)	23 (23.50)	11 (11.20)	1 (1.00)	35 (35.70)	98 (100.00)
> 2 to 3	10 (10.30)	53 (54.60)	63 (64.90)	18 (18.60)	16 (16.50)	0 (0.00)	34 (35.10)	97 (100.00)
> 3 to 4	10 (10.00)	50 (50.00)	60 (60.00)	24 (24.00)	16 (16.00)	0 (0.00)	40 (40.00)	100 (100.00)
Total	40 (13.60)	146 (49.50)	186 (63.10)	65 (22.00)	43 (14.60)	1 (0.30)	109 (36.90)	295 (100.00)

Table 4 Prediction of the relationship of various factors with compliance in wearing the retainer using binary logistic regression (enter method).

Variable (ref)	Crude OR	Adjusted OR (95 % CI)	P value
Age (ref: working-age group)	1.74 (1.05-2.88)	2.93 (1.28-6.73)	0.011
Number of recall visits (ref: 0 time)			
1 time	1.14 (0.65-1.99)	2.40 (1.12-5.16)	0.025
2 times	1.12 (0.47-2.65)	3.09 (0.91-10.46)	0.070
More than 3 times	0.52 (0.18-1.49)	1.01 (0.25-4.03)	0.986
Experience in losing or breaking a retainer (ref: no)	1.56 (0.93-2.63)	2.83 (1.38-5.79)	0.004
Self-assessment level of compliance in wearing the retainer (ref: 0-7 score)	13.08 (7.39-23.16)	20.40 (10.25-40.61)	< 0.001
Knowledge on frequency of wearing the retainer (ref: did not know)	1.61 (0.66-3.92)	4.61 (1.41-15.03)	0.011

OR = odds ratio, CI = confidence interval, Supplementary Table 4 (Available at https://kb.psu.ac.th/psukb/bitstream/2016/19405/1/Supplementary-Table-4.pdf)

Table 4 showed that 5 of the 19 factors were significantly associated with compliance: age (P = 0.011), number of recall visits (P = 0.025), experience in losing or breaking a retainer (P = 0.004), self-assessment level of compliance in wearing the retainer (P < 0.001), and knowledge on the frequency of wearing the retainer (P = 0.011). The factor with the most predictability was the self-assessment level of compliance in wearing the retainer. Also, patients who assessed themselves to be compliant in wearing their retainer with scores of 8-10 had a 20.40 times greater opportunity to wear the retainer than the patients who assessed themselves at scores of 0-7 (odds ratio = 20.40, P < 0.001).

Discussion

The objectives of this research were to assess patient compliance and the factors that influenced compliance to wearing the retainer using telephone interviews. The response rate was 97 % which is considered to be at a good level.[28] Only 60 % of patients continued to wear their retainers four years after the completion of orthodontic treatment. The results of the telephone interviews revealed that up to 16 % of patients discontinued the use of their retainer by the end of four years. It is information from Table 3. Additionally, five factors were associated with the level of compliance.

There is a difference between 'ideal definition' and 'operational definition' of patient compliance. Ideally, patient compliance measured by observing the patient's adherence to the dentist's instructions. However, there are two major problems: firstly, a variety of retention protocols from different orthodontists, and secondly incomplete data regarding orthodontist instruction in the chart record. Hence, operational definition in this study was wearing a retainer at least every nighttime. According to the study, using a retainer for a minimum of 10 hours per day is enough to preserve the proper position of the teeth.[29] Moreover, a systematic review in 2020 found no statistically significant difference in outcomes between patients who wore retainers full-time versus part-time.[12]

The compliance rate in this study, measured more than 2 years to 3 years after debonding, was 64.90 %. This outcome approximates the findings of a research conducted by Pratt et al.,[14] which had comparable criteria for compliance. According to their analysis, the percentage of patients who consistently wore their retainers every night after having their braces removed for a period of two years was within the range of 34-68 %.[14] From another study by Kacer et al.,[13] the compliance rate was 55 % at 7-9 months after debonding, which was lower than this current study at two years after debonding. The population in the Kacer et al. study was advised to wear the retainers for only 2 years; therefore, the compliance rate would be expected to decrease in the second year.

This current research revealed that school-age patients were more compliant than patients in the working-age group. The school-age group demonstrated a 2.93 times greater opportunity to cooperate in wearing the retainer than the working-age group. This was consistent with other research that indicated younger people were more compliant in wearing a retainer than older people.[14,20] Perhaps teenagers simply prefer to wear retainers, while working people pay more attention to their work. Nevertheless, some studies have shown that age does not have any influence on compliance in wearing a retainer.[13,19,21]

This research discovered new factors related to compliance in wearing a retainer. The new factors included the number of recall visits, experience in losing or breaking a retainer, self-assessment level of compliance in wearing the retainer, and knowledge on the frequency of wearing the retainer. These factors had different predictive values, with 95 % CI of odds ratios ranging from 2.40 to 20.40. The results of the self-assessment level of compliance in wearing the retainer factor can be applied to a follow-up screening question. If the patient's score is 0-7, the orthodontist may spend more time motivating the patient to adhere to wearing the appliance and arrange for more recall appointments.

Furthermore, it is imperative for orthodontists to provide patients with information regarding the recommended frequency of wearing removable retainer. Education and raising awareness should not be done only at the end of fixed appliance treatment but also during the entire course of orthodontic therapy.

The strength of this research is the method of data collection by telephone interview, which resulted in a high response rate.[30,31] The use of the telephone allows interviewers to cover a greater geographic area[30-33] and provide greater flexibility for scheduling.[30,31,33] Even though the time-consuming,[30,31,34] the incapacity to react to visual cues, and the possible loss of contextual data

are some of the most frequently expressed concerns regarding telephone interviews.[33] However, telephone interviews also have the advantage of reducing costs (compared with face to face interviews), increasing interviewer safety, perceiving anonymity, increasing privacy for respondents, and reducing distraction (for interviewees) or self-consciousness (for interviewers) when interviewers take notes during interviews.[35,36]

A limitation of the study was the measurement of dependent variables using subjective data collection. The validity of the data therefore depended on the ability of the interviewer to interpret and summarize the information. In general, patients will tend to overestimate the time spent wearing the retainer. As a result, the compliance rate may be exaggerated. The researcher designed additional questions to cross-check the answers. An additional limitation was that a number of patients were excluded because they could not be contacted by telephone.

Moreover, this study was conducted at the university dental hospital. To extrapolate the findings to other setting should be carefully considered. Future research on other populations should be recommended.

Conclusions

Within 4 years of observation after debonding. The factors found to be associated with compliance in wearing the retainer were the patient's age, number of recall visits, experience in losing or breaking a retainer, self-assessed level of compliance in wearing the retainer, and knowledge of the frequency of wearing the retainer.

Author contributions

LJ: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources Data Curation, Writing-Original Draft, Writing-Review & Editing, Visualization, and Project administration; SS: Conceptualization, Resources, Writing-Original Draft, Writing-Review & Editing, Visualization, and Supervision; ST: Methodology, Validation, Formal analysis, Writing-Original Draft, Writing-Review & Editing, Visualization, and Supervision.

Ethical statement

Disclosure statement

Authors have no the conflict of interest.

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