

## Orthodontic Treatment Compliance and Duration Among Adolescent and Young Patients at Smiles Dental Clinic

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### Abstract

**Introduction:** Patient compliance is a core issue as it can strongly affect the objectives and results of orthodontic treatment and the length of time a patient must wear orthodontic appliances.

**Objective:** This study aimed to explore factors affecting compliance and duration of orthodontic treatment among patients at Smiles Dental Clinic, Dar Es Salaam, Tanzania

**Methods:** Dental records for 2016 to 2023 of 176 adolescent and young orthodontic patients aged 10 to 24 years were extracted from a private dental clinic in the city of Dar Es Salaam. The collected secondary data included the age and sex of the patient, duration of treatment, missed appointments, oral hygiene, bracket and molar tube failure, insurance status and whether a patient was a day or boarding school student.

**Results:** The majority of the patients demonstrated inadequate compliance with orthodontic treatment. A significantly higher proportion of non-insured patients (15.9%) demonstrated good compliance to orthodontic treatment than insured (5.9%). A significantly high proportion of boarding school patients missed appointments and frequently experienced breakage of orthodontic appliances. Treatment duration was significantly longer in patients who missed appointments, with poor compliance and bracket and/or molar tube breakage. Variance in treatment duration was explained most significantly by bracket breakage.

**Conclusion:** The studied patients had poor orthodontic compliance, which negatively impacted the treatment duration.

**Keywords:** Orthodontic, Compliance, Orthodontic Treatment, Bracket, Molar Tube, Breakages, Tanzania.

### Introduction

According to clinical realms and research evidence, patient compliance is a core issue as it can strongly affect the objectives and results of orthodontic treatment and the length of time a patient must wear orthodontic appliances. The diagnostic and clinical skills of the orthodontist, favourable biological characteristics of the patient (bone turnover, craniofacial morphology, stage of growth, etc.), the patient's willingness to cooperate during treatment and to follow all treatment recommendations (i.e. patient compliance), and the use of an appropriate and effective orthodontic appliance are key to the success of orthodontic treatment (Chow & Cioffi, 2018).

The issue of patient compliance is complex, multifactorial and wide-ranging in nature. Compliance in orthodontics relates to keeping appointments, following oral hygiene instructions, wearing elastics and other patient-dependent appliances, and avoiding hard sticky food that might debond the brackets and other parts of the appliance (Aljabaa et al 2015). Previous studies attempted to predict the factors that might affect compliance during orthodontic treatment. Patient-related factors such as the desire for treatment and relationship with parents were considered important factors motivating patients to comply (Mehra et al, 1998; Tuncer et al 2015).

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Verbal praise and communication were rated as important methods for improving compliance (Lin et al, 2015). On the other hand, pain and inconvenience associated with fixed orthodontic appliances were inversely correlated with compliance (Egolf et al, 1990). Reduced patient compliance results in increased treatment time and additional costs to both the healthcare provider and the patient (Richter et al, 1998).

The outcome of orthodontic treatment can be influenced by the relationship between the clinician and the patient which impacts adherence to appliance care and maintenance of oral hygiene (Kafle et al., 2020). In most cases, patients are blamed for not complying with treatment recommendations without considering the practitioner's ability to understand individual patient's needs and to make appropriate treatment plans taking into account other socio-economic factors. Bracket failure during orthodontic treatment has been associated with orthodontic emergencies and delayed treatment time (Khan et al., 2022) and is a common problem in adolescent patients than adults (Bukhari et al., 2016). It has been observed that compliance of school children with orthodontic appliances in boarding schools is highly affected by the failure of pupils and students to attend scheduled follow-up appointments due to school regulations and academic reasons. This eventually affects the cost and duration of the treatment time.

Studies have shown that adherence to orthodontic treatment follow-up visits strongly correlates with health insurance status. Medical-insured patients are more likely to miss orthodontic treatment follow-up visits than non-insured patients (Vithanaarachchi et al., 2017). In Tanzania, major insurance companies include the National Health Insurance Fund (NHIF), Jubilee, Strategis and the National Social Security Fund (NSSF). Recently, awareness of orthodontic treatment in Tanzania is picking up as more and more patients request their health insurers to cover orthodontic treatment. Therefore, this retrospective clinical cohort study aimed to explore factors affecting orthodontic treatment compliance among patients seen at the Smiles Dental Clinic, in Dar Es Salaam, Tanzania.

Smiles Dental Clinic is a privately owned health facility located in the city centre of Dar Es Salaam region, a major commercial city in Tanzania. The clinic provides orthodontic and other types of dental treatments. On average, the clinic provides dental treatment to 500 patients per month. The clinic began to accept NHIF patients in 2016.

## **Materials and methods**

We conducted a prospective cohort study of 176 patients aged 10 – 24 years who were treated with fixed orthodontic appliances stainless steel 0.022-inch MBT and 0.018-inch Roth bracket system from 2016 to 2023. Sixteen patients who did not initiate orthodontic treatment at Smile Dental Clinic were excluded from the analysis. As a standard practice, patients under treatment were reviewed every 6 to 8 weeks, and comprehensive clinical notes were recorded at every visit. At the beginning of the treatment, all brackets were conventionally ligated with elastomeric ties. During data collection, patients' clinical notes were retrieved to record information on orthodontic compliance and treatment duration which was measured in months and later converted in years. Other collected information included demographic profile, oral hygiene, number of missed appointments, number of visits with reported appliance breakage (incidence of breakage) and total numbers of breakage (broken brackets and/or bands), bracket and molar tubes failure, insurance status and whether a patient was a day or boarding school student. For each visit made, the Periodontal Index was used to assess the patient's oral hygiene and a score of 0 and 1 was assigned for poor and good oral hygiene respectively. Compliance with orthodontic treatment was assessed by two items which included several missed

scheduled appointments and oral hygiene status. Thus, a composite score of the two items was generated and dichotomized into good and poor compliance

Collected data was analyzed using SPSS version 23.0 (IBM Corp, Armonk, NY, 2015). Chi-square statistics was used to test the association between orthodontic treatment compliance and independent variables including age, sex, treatment duration and the number of times molar tube and bracket break. T-test was used to compare treatment duration between groups (compliance versus non-compliance; and bracket or molar tube failure versus non-failure). The level of significance was set at  $P < .05$ .

### Ethical considerations

Permission to conduct this retrospective study was obtained from Smiles Dental Clinic administration with the approval letter No. SDC/RES/23/01 The study was conducted according to the ethical principles outlined in the Declaration of Helsinki.

### Results

The mean age of studied adolescents and young patients was 16 years (SD = 3.6). Over half of the orthodontic patients did not have health insurance. The majority of the patients (89.2%) had poor compliance to orthodontic treatment but did not vary with adolescents' and young's sex and age. However, significantly high proportions of uninsured adolescents and young orthodontic patients (15.4%) and those in day school (16%) had good compliance to orthodontic treatment compared to insured clients (5.9%) and patients in boarding schools (6.9%) respectively. Patients with poor compliance experienced more incidences of broken brackets and molar tubes (Table 1). However, the frequency of broken bracket and/or molar tubes did not vary with sex and age (Table 2).

**Table 1. Profile of Studied Orthodontic Patients**

	<b>Patients with poor treatment compliance</b>	<b>Patients with good treatment compliance</b>
All	157 (89.2)	19 (10.8)
Mean number of visits (SD)	2.6 (1.4)	4.8 (1.2)***
<b>Sex</b>		
Males	58 (90.6)	6 (9.4)
Females	99 (88.4)	13 (11.6)
<b>Age</b>		
10 – 14 years	56 (88.9)	7 (11.1)
15 – 19 years	58 (90.6)	6 (9.4)
20 – 24 years	47 (87.8)	6 (12.2)
<b>Health insurance</b>		
Insured	80 (94.1)	5 (5.9)
Not insured	77 (84.6)	14 (15.4)*
<b>School/College/University</b>		
Boarding	94 (93.1)	7 (6.9)
Day	63 (84.0)	12 (16.0)*
<b>Broken brackets</b>		
None	26 (66.7)	13 (33.3)
Up to two times	94 (94.9)	5 (5.1)
More than twice	37 (97.4)***	1 (2.6)
<b>Broken molar tube</b>		
None	41 (77.4)	12 (22.6)
Up to two times	111 (94.1)	7 (5.9)
More than two times	5 (100)***	0 (0.0)

\* $P > 0.005$ ; \*\* $P > 0.001$ ; \*\*\* $P > 0.0001$

**Table 2. Mean and Proportion of Patients with Brackets and /or Molar Tube Breakage**

Breakage frequency	Male (n=64)	Female (n=112)	All (n=176)
0	12.5	16.1	14.8
1	18.8	23.2	21.6
2	18.8	18.8	18.8
3	21.9	17.0	18.8
4	7.8	9.8	9.1
5	6.3	8.9	8.0
6	6.3	2.7	4.0
7	3.1	0.9	1.7
8	3.1	1.8	2.3
9	1.6	0.9	1.1
Mean (SD)	2.8 (2.2)	2.4 (1.9)	2.5 (2.0)
Age			
10 – 14 years	22 (88.0)	24 (85.7)	46 (86.8)
15 – 19 years	17 (81.0)	29 (87.9)	46 (85.2)
20 – 24 years	17 (94.0)	41 (80.4)	58 (84.1)
All	56 (87.5)	94 (83.9)	150 (85.2)

Treatment duration was significantly longer for patients with poor compliance, broken molar tubes and brackets, and those in boarding schools (Table 3). When compared to day scholar patients, a significantly high proportion of boarding school patients had missed dental appointments, poor compliance, broken brackets and broken molar tubes. On the other hand, a significantly high proportion of day scholar patients had visited dental clinics for orthodontic treatment more than twice (Table 4). In multiple logistic regression, only the broken bracket maintained its significant association with poor orthodontic treatment compliance (Table 4).

**Table 3. Mean Treatment Duration**

	Number of patients	Mean	Standard deviation	P value
<b>Sex</b>				0.433
Male	64	2.45	0.61	
Female	112	2.38	0.66	
<b>Broken bracket</b>				0.005
Yes	39	2.5	0.6	
No	137	2.1	0.5	
<b>Broken molar tube</b>				0.000
Yes	53	2.5	0.6	
No	123	2.1	0.5	
<b>School/College/University</b>				0.026
Boarding	101	2.5	0.6	
Day	75	2.3	0.7	
<b>Treatment compliance</b>				0.003
Good	19	2.0	0.5	
Poor	157	2.5	0.6	

**Table 4. Comparison of Treatment Compliance and Duration, and Appliance Breakage Among Boarding and Day Scholar Orthodontic Patients**

	Boarding (%)	Day (%)	All (%)	P value
Missed appointment	93 (92.1)	56 (74.7)	149 (84.7)	0.002
Poor compliance	94 (93.1)	63 (84.0)	157 (89.2)	0.048
Broken molar tube	77 (76.2)	46 (61.3)	123 (69.9)	0.033
Broken bracket	86 (85.1)	51 (68.0)	137 (77.8)	0.007
Made 2 or more visits	54 (53.5)	51 (68.0)	105 (59.7)	0.036

**Table 5. Factors Associated with Inadequate Orthodontic Treatment Compliance**

	*Adjusted OR	95% CI
<b>Broken molar tube</b>	1.6	0.5 – 5.2
Yes		
No	1	
<b>Broken bracket</b>		
Yes	<b>5.4</b>	<b>1.6 – 18.1</b>
No	1	
<b>Health insurance</b>		
Yes	0.3	0.1 – 1.2
No	1	
<b>School/College</b>		
Day	0.9	0.3 – 2.8
Boarding	1	
<b>Dental visits</b>		
2 or more visits	0.1	0.1 – 1.2
One visit	1	

\*Controlled for age and sex

## Discussion

Compliance means acting by a specific goal, desire, request, condition or direction. Orthodontic treatment typically lasts 1 to 3 years, and therefore patient compliance needs to be sustained throughout the treatment period (Cărămidă et al., 2021). Apart from duration, orthodontic treatment compliance is also influenced by the frequency of treatment schedules and the complexity of the required behaviours. The notation that reduced patient compliance results in increased treatment time was also affirmed by our study. Treatment duration was significantly longer for patients with poor compliance probably because of inadequate monitoring of the treatment progress due to missed appointments. This finding is in line with what has been reported by another study conducted outside Tanzania which demonstrated that prolonged treatment time is associated with missed appointments, band/bracket breakage and increased lower incisor inclination (Li et al., 2016; Farruqui et al., 2018). However, in our study, the variance in treatment time was explained most significantly by breakages. Similar findings have been reported by other studies which attributed most of the variance in treatment time to the number of missed appointments and breakages (Farruqui et al., 2018).

Although it is well known that sending appointment reminders to orthodontic patients is effective in improving dental attendance and reducing the treatment duration and bracket bond failure (Li et al 2016; Al-Abdallah), managing patients who are in boarding school present a challenge of reduced dental attendance. In this study, a high proportion of patients in boarding made few dental

visits and experienced more appliance breakage which may have contributed to the long treatment duration in this group.

The experience of appliance breakage was the same for male and female orthodontic patients. This is in contrast to the finding of another study in which females had significantly better compliance (Al-Abdallah et al., 2021). The incidences of broken brackets and/or molar tubes may have disrupted the healing process which led to longer treatment duration. This is in line with the findings of a study which demonstrated that on average, treatment time increases by 0.6 months for each additional failed bracket (Stasinopoulos et al., 2018).

Failure of boarding school orthodontic patients to attend regular follow-up appointments in most cases is due to academic reasons, especially for patients in their final year of studies. Therefore, during orthodontic treatment planning, careful consideration should be observed before initiating fixed orthodontic treatment.

In line with the findings of other similar studies (Bukhari et al, 2016; Li et al, 2016), this study indicated that a significantly high proportion of uninsured patients demonstrated good orthodontic treatment compliance compared to insured patients. majority of patients with insurance packages demonstrated inadequate compliance to orthodontic treatment compared to non-insured patients. However, a significant association between orthodontic compliance and health insurance status disappeared in multiple logistic regression. This may be due to the small sample size of the current study.

Similar to the observations of other studies (Kafle et al. 2016; Farruqui et al., 2018), our study did not find a significant association between orthodontic treatment compliance and age, and sex. However, other studies have reported sex and age to be significant factors in patient compliance (Nahajowski et al., 2022; Tsomos et al. 2014; Barbosa et al., 2018). Several reasons may explain the observed differences. Our study focused only on adolescents and young people who were treated with fixed orthodontic appliances while other studies included older people in the study population, assessed compliance and treatment duration of removable orthodontic appliances and used a different approach to data collection.

## Conclusion

Poor orthodontic compliance and appliance breakage particularly among patients in boarding schools compromised treatment duration. Orthodontists should be careful when preparing treatment plans for patients who are in boarding schools.

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