

Comparison of relapse between fixed bonded-type & removable Essix-type retainers in mandibular anterior segment 06 months after debonding

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Abstract

Introduction: Despite the significant advancements made in orthodontic treatments, retaining the desired tooth alignment remains a significant issue. Studies show that only 10% of individuals who underwent orthodontic procedures maintain their proper bite alignment 20 years post-retention, as assessed by orthodontic professionals. Furthermore, there is limited understanding of patients' perspectives regarding orthodontic relapse. Objective was to compare the mean relapse between Fixed Bonded-type and removable Essix-type retainers in the mandibular anterior segment 6 months after debonding.

Material and Methods: The study was conducted in the Department of Orthodontics at KRL Hospital, Islamabad. Duration of study was 1 year and 60 patients were selected, divided into 2 groups (Essix and Fixed). Little's Irregularity Index was used to evaluate pre-debonding and 6 months post-retention mandibular anterior sextant alignment on models thereby evaluating relapse in Essix retainers and Fixed retainers group. Data was analyzed using SPSS and Post stratification independent T test was applied.

Results: Irregularity Index of the lower incisors showed a notable rise in patients using Essix retainers during the retention period, compared to those who had Fixed retainers. Additionally, patients using mandibular Essix retainers reported feeling significantly more crowded than those with Fixed retainers.

Conclusion: Compared to Fixed retainers, Essix retainers tend to cause more movement of the lower incisors. The discovery that only half of patients with general crowding are actually aware of it, suggests that the increased perception of crowding by Essix retainer patients may not be solely due to actual crowding, but could be influenced by other factors.

Keywords: Retention; retainers; little's irregularity index; relapse; mandibular anterior segment

Introduction

It is widely recognized that orthodontic care can enhance one's looks, oral performance, psychological and social

well-being, and overall life satisfaction.¹ Orthodontic relapse refers to the reappearance of the original misalignment after it has been corrected, and it is a common hazard for all orthodontic patients.² Orthodontists try to prevent this by using different retention procedures. Studies have revealed that the periodontal ligament requires a period of 3-4 months for remodeling, while the reorganization of collagenous fiber networks takes 4-6 months.

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The elastic supracrestal fibers may take up to a year to settle. Due to these factors, the likelihood of relapse is highest directly after orthodontic treatment and within the first 12 months. Retainers are employed to prevent movement until the gums and periodontal structures have fully recovered and skeletal growth is completed. There are different types of retaining appliances, including bonded 3-3 retainers, removable acrylic wire retainers, and invisible suck down retainers.⁴ Maintaining orthodontic results in the long term is crucial, and fixed retention is a popular method for ensuring stability after treatment has been completed.⁵ Fixed retainers offer several benefits compared to removable ones, such as invisibility, high tolerance by patients, and no need for compliance. However, there are also drawbacks associated with fixed retainers, including difficulties in placement, potential for tooth movement caused by wire distortion or lack of wire passivity, and issues such as bonding failures and wire fractures. A review study found that the failure rate of bonded retainers can range from 10.3% to 47.0% and can be caused by failures in either the adhesive-enamel bond or the wire-composite interface.⁶ Despite advancements in the field, Hawley-style retainers constructed of acrylic and stainless steel wire components still have some limitations. These types of retainers can either be made with cold or heat-cured acrylic, but have some drawbacks. The primary material is still typically perceived as being delicate, fragile, and pliable in terms of its physical properties. Although stainless-steel components are stronger, longer-lasting, and more stable, they can experience work hardening.⁷

Essix retainers were designed as a budget-friendly, comfortable, and aesthetically pleasing substitute to common bonded retainers and removable dental appliances.⁸ The Essix retainer provides good short term retention. However, the growth of bacteria on these acrylic and plastic materials highlights the importance of thorough cleaning.

Additionally, discoloration can occur to different extents.⁹

In this study, the outcome of both fixed and removable Essix-type retainers in our population is evaluated, to identify which of the types is more beneficial for the patients with minimum relapse after the fixed orthodontic treatment.

Materials And Methods

This study was conducted at Department of Orthodontics, KRL Hospital G-9, Islamabad, Pakistan. Non-probability purposive sampling technique was used with a sample size of 60 patients calculated through WHO calculator and divided equally into 2 groups. Group 1 subjects were given removable Essix retainers and Group 2 subjects were given bonded retainers at the time of debonding. Mean of Group 1 = 1 mm with SD of ± 0.5 Mean of group 2 = 0.7 mm with SD of ± 0.5 90% power, significance level of 0.05 & 95% confidence level. Group A subjects were given removable Essix retainers whereas Group B subjects were given bonded retainers at the time of debonding. Age range and gender distribution in both groups were similar to control bias. Randomization was done by lottery method. The principal investigator bonded fixed retainer and inserted the removable retainer. The principal investigator collected data consisting of patients' dental casts of lower anterior teeth. Dental casts were taken at the commencement (T0), before debonding (T1) and 6 months after debonding (T2). Five measurements of each patient were recorded on T1 & T2 from the contact point of one tooth to another in the lower anterior segment and then mean relapse of one group was assessed according to the Little's Irregularity Index and then both groups were compared in order to assess which group gives better retention. Finally, relapse (T1-T2) was measured after the last T2 cast which was taken after 6 months of debonding.

Data was analyzed using SPSS. Percentage & frequency was computed for gender and

malocclusion while mean & SD for relapse, age and initial crowding. Independent sample T was employed to compare mean relapse among the groups with P value ≤ 0.05 i.e. significant. Stratification technique was used to control confounding variables like age, gender and malocclusion, to efficiently observe an effect on outcome.

Inclusion	Exclusion
<ul style="list-style-type: none"> 13 - 25 years age, Male and Female patients 	<ul style="list-style-type: none"> Pre-treatment crowding more than 15 mm
<ul style="list-style-type: none"> Patient who have completed upper and lower fixed orthodontic treatment 	<ul style="list-style-type: none"> Poor periodontal condition Trauma
<ul style="list-style-type: none"> Pre-treatment crowding ranging from 3 mm - 15 mm Extraction and Non-Extraction cases both included randomly 	<ul style="list-style-type: none"> Extraction of any anterior tooth/teeth
<ul style="list-style-type: none"> Clinically diagnosed Class I or II dental malocclusion. 	

Results

Out of 60 patients, 40 % (n=24) were males while 60% (n=36) were females. However, gender distribution of group A was 33% males and 67% females and 43% males and 57% females in group B. Mean age amongst both the groups was 20.95 years.

45% of the patients (n=27) showed crowding more than 3.5 to less than 9 mm whereas 55% of the patients (n=33) showed crowding between 9.1 - 14 mm. When malocclusion was assessed, it was found that 50% of the patients (n=30) had class I malocclusion while 50% had class II malocclusion. Mean relapse in group A was 0.36mm (SD, 0.14mm) and in group B 0.54mm (SD, 0.12mm).

Measurements were done on casts for T1 (debond) and T2 (6 months post-retention). There was highly significant ($p < .000$) difference between the two groups (Table I). At 6 months after debond, a statistical significance was found in the differences between the groups in terms of Little's irregularity index.

Tables II and III showed age based stratification. P-value calculated for age group 15-20 years was 0.003 while that for age group 21-25 was 0.004 depicting that though age had significant impact on relapse however the amount of relapse among both groups was comparable.

Malocclusion based stratification for relapse between both the groups showed that there was significant difference in the little's irregularity index in both the fixed and Essix group, hence showing that malocclusion had no role in the relapse and this confounding variable is controlled. (Table IV, V)

Tables VI and VII showed crowding based stratification for relapse between both the groups; statistically significant difference in the little's irregularity index was found in both fixed and Essix group hence showing that crowding had no role in the relapse in our study and this confounding variable is controlled.

Table I: Comparison of Relapse between both groups

Groups	Mean	Std. Deviation	p- value
Group A	0.383	0.111	0.000
Group B	0.573	0.153	

Table II: Age based stratification (15-20 years) for Relapse between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	16	0.3062	0.12894	0.003
Group B	11	0.5182	0.1328	

Table III: Age based stratification (21-25 years) for Relapse between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	14	0.4286	0.09945	0.004
Group B	19	0.5526	0.12188	

Table IV: Stratification (Class 1) for Relapse between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	15	0.367	0.104	0.001
Group B	15	0.567	0.171	

Table V: Stratification (Class II) for Relapse between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	15	0.4	0.119	0.001
Group B	15	0.58	0.137	

Table VI: Crowding (3.5-9) based stratification for Relapse Between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	15	0.36	0.105	0.001
Group B	12	0.61	0.152	

Table VII: Crowding (9.1 - 14) based stratification for Relapse Between both groups

Groups	n	Mean	Std. Deviation	P-value
Group A	15	0.407	0.116	0.001
Group B	18	0.544	0.15	

Discussion

In orthodontics, there is a focus on considering various factors such as patient needs, oral health, appearance, and preserving the results achieved during treatment. This clinical trial aimed to compare the efficacy of the two retainer types in maintaining the alignment of the lower incisors up to 6 months post-removal.

Randomization in the study aims to evenly distribute possible confounding factors like initial malocclusion, treatment approach, irregularity, and mechanics among the groups, so that the groups are balanced except for the type of intervention. This study had successful randomization and the two groups were well-matched in terms of demographic characteristics. There was a slightly higher age range in the Essix retainer group due to the inclusion of two older participants, and a higher proportion of female participants.¹⁰⁻¹³ This is a trend commonly observed in orthodontic studies and may be due to higher levels of self-awareness and concern for dental health among women, as well as a greater desire for orthodontic treatment.¹⁴⁻¹⁵

The study participants had a higher representation of Class II Division 1 malocclusions.¹⁶ This is due to the higher

occurrence of this type of malocclusion in the general population and among individuals seeking treatment.¹⁷

Both treatment groups saw a median rise in Little's Irregularity Index in the first half-year following debond, which was comparable to the increase reported in previous studies, regardless of the retention regimen or type of retainer used.¹⁸⁻²¹

Störmann and colleagues in their study concluded that the canine-to-canine retainer was more stable compared to the retainer bonded to 2 teeth (post 24 months retention), which seemed to be related to recurrent movement of the unbonded incisors.²⁰

A study by Katsaros et al. investigated relapse following 3-3 fixed bendable spiral retainer and found that out of 21 patients with complications, 18 had a difference in torque between two adjacent lower incisors and 2 had a flared mandibular canine (03 years retention).²²

Watted and their team conducted a study to assess the effect of lower cuspid-to-cuspid lingual retaining appliances attached to either 2 or 6 teeth on incisor mobility. The results indicated that tooth movement reduced as more teeth connected to the retainer. However, the study did not identify the type of removable retainer used for the control group and did not examine patient perceptions.²³

A study conducted by Renkema and their team focused on the effectiveness of lower cuspid-to-cuspid bonded retainers and found that these retainers can successfully maintain the alignment of the mandibular front teeth after active orthodontic treatment has been completed.²⁴

Our study suggests that, at least for the first 6 months after debonding, a bonded retainer is more effective than a transparent removable retainer in preserving straightened lower 4 incisors. Changes in Little's irregularity index over time could be a result of ongoing growth or noncompliance with the retention protocol, especially with the invisible suck down retainer, which is removable. Other potential

causes for changes in alignment may include poor fit of the removable retainer, breakage of the fixed retainer to stay in place, and inability of the retaining appliance to arrest any kind of movement.²⁵⁻²⁶

This study did not assess patient adherence to retainer wear, so it's unclear if some of the observed relapse may have been caused by patients not following the retention protocol rather than a fault with the retainer itself. Previous research on compliance with various orthodontic protocols has shown inconsistent results, indicating the challenges of accurately tracking patient adherence.²⁷⁻²⁸

In 1998, a clinical trial was conducted to compare the effects of acrylic wire and invisible suck down retainers during the initial 24 weeks of maintenance. The trial focused on the changes to incisors and involved 40 patients, with half assigned to each type of retainer. However, it's important to note that the design of the Essix retainer used in the study only covered the area from 3 to 3 in the upper and lower jaw, which is not usual for this type of retainer. Many orthodontic professionals use a design that encompasses the entire dental arch. The results of the trial showed no significant differences in incisor irregularity between the two types of retaining appliances.²⁹

In another study, 396 subjects were haphazardly given either an acrylic retainer or invisible retainer, though in each group 155 were finally examined. At the removal of braces stage the models of the upper and lower dentition and 24 weeks into maintenance were evaluated for the Irregularity Index of the anterior 6 teeth. Noteworthy change was detected in the Irregularity Index for the acrylic retainer group compared to the invisible suck down retainer group.¹⁸

Challenge in conducting this study was to book an appointment with patients at 06 months post retention phase, however this was ensured through repeated contacts. Another issue was few patients has cracked

Essix or fractured fixed retainers. Such patients were excluded.

Conclusions

Our study concluded that Essix retainers have increased relapse in terms of crowding than permanent retainers in lower anterior six teeth.

At 6 months after debond there was notable difference in the irregularity changes between the groups. Thus, the null hypothesis can be void. When compared with essix retainers, the bonded retainers have additional effectiveness in maintaining the incisor alignment in the lower teeth in the initial 6 months after removal of fixed braces.

Retention protocols can be modified by having knowledge about the variability that is present between different types of retainers in preventing anterior teeth movement. A more extensive prospective randomized clinical trial can be done with the details mustered in this study.

Recommendations

The study of retention could benefit from some improvements in methodology. A prospective and randomized study would be the ideal approach, but it would be best to have canines erupted in the arch to allow for pre-treatment measurements of crowding. Other factors that should be taken into consideration include the extraction of premolars, the inclination of incisors, the type of malocclusion, the type of treatment used, the treatment time frame, the schedule of treatment, and the use of a device to measure the duration of appliance usage.

Conflict of Interest

No conflict of interest

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