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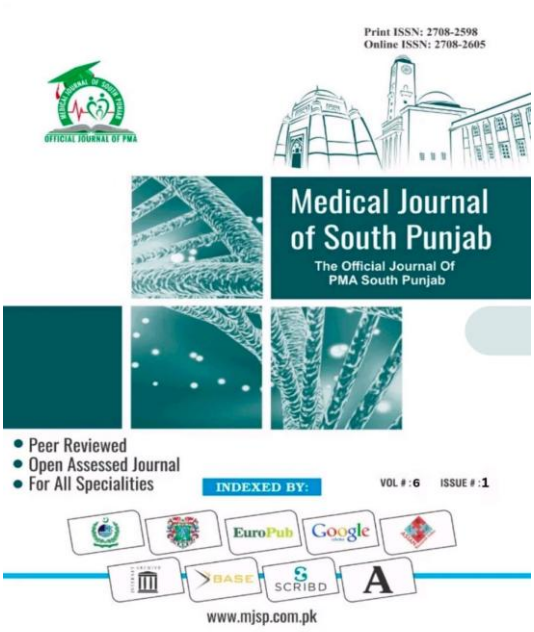

Is Vacuum formed Retainer better than Bonded Retainer? single blind, randomized Controlled Trial

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Original Article

Is Vacuum formed Retainer better than Bonded Retainer? single blind, randomized Controlled Trial

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ABSTRACT

Objective: This prospective trial aimed to compare the clinical effectiveness of bonded retainers versus vacuum-formed retainers in maintaining lower arch alignment after orthodontic treatment over an 18-month period.

Methods: Study was conducted at orthodontic department of NID, Multan from June 2022 to December 2023. Patients having all treatment records including models, nearing end of orthodontic treatment, clinically satisfactory treatment results and alignment were included. A total of ninety patients included 45 patients in bonded retainer group and 45 in vacuum formed retainer group. Subjects were monitored at 6, 12, and 18 months with mandibular arch impressions taken for measurement. Lost retainers were replaced, and broken retainers were repaired at a daily emergency clinic.

Results: It was seen that little's irregularity index was relatively high in Group B than Group A, ($p<0.001$). Intercanine width was also relatively high in Group B than Group A, ($p<0.001$). But intermolar width was relatively high in Group A than Group B, ($p=<0.001$). Arch length in Group A was slightly high than the Group B, ($p=p<0.001$). But extraction site space in Group A and Group had almost same occurred and the difference was statistically insignificant, ($p>0.050$).

Conclusion: Bonded retainers have been shown to maintain superior mandibular incisor alignment compared to vacuum-formed retainers during the first six months following debonding, with studies indicating that these retainers provide more stable and consistent positioning of the incisors. Over an extended period of up to 18 months, the alignment achieved with bonded retainers remains largely stable, demonstrating only minimal changes.

Keywords: Vacuum Formed Retainer, Bonded Retainer, Debonding, Mandibular Incisor Alignment.

1. INTRODUCTION

The main purpose of orthodontic treatment is to attain an ideal occlusion position that is stable in form, aesthetically pleasing, and functional [1]. However, even with accurate diagnosis and meticulously applied treatment techniques, the outcomes attained after active treatment may not remain stable in the long run [2]. Relapse after treatment is one of the common risks in cases of orthodontic treatment [3]. To avoid disappointment for both the clinician and the patient, proper planning for treatment strategy retention and stability should be discussed with the patient before starting approval of consent and treatment [4].

Studies have thoroughly examined stability and relapse in treated and untreated malocclusions over many years, with findings that are generally not very optimistic [5]. Sadowsky and Sakols [6], for example, tracked patients for an average of 20 years after retention and observed that 9% of these patients experienced an increase in crowding of mandible compared to their before-treatment condition, while 73% had relationships with dental treatments and “outside the norm.” Similarly, research by Little and colleagues [7] found that 20 years of satisfactory results of mandibular incisor alignment are associated with only 10% of patients.

Long-term retention is essential for long-term stability in orthodontic treatment due to multiple factors influencing tooth positions in untreated and treated cases [8]. These factors include the growth of soft tissue and skeletal growth, treatment plan and dental changes, final interdigitation, treatment plan specifics, pretreatment malocclusion characteristics, and functional occlusion [9]. Retention helps reorganize gingival and periodontal tissues, counteracts movement from growth changes, and prevents relapse of teeth moved to unstable positions [10].

This study aimed to quantify and compare intra-arch changes using vacuum-formed and bonded retainers at 6, 12, and 18 months post-deboning, to assess which retainer better maintains orthodontic outcomes.

2. METHODOLOGY

The study was conducted at the orthodontic department of NID, Multan from June 2022 to December 2023. Patients having all treatment records including models, nearing the end of orthodontic treatment, clinically satisfactory treatment results, and alignment were included. Patients with early completion of treatment multiple breakages during the treatment plan, patients with poor oral hygiene, periodontal disease, need for prosthodontic in the arch of mandible, and patients having difficulty in learning like special cases were excluded. Randomization of patients was made by computed generated numbers (odds and even) and a group of treatments was assigned. A total of ninety patients included 45 patients in the bonded retainer group and 45 in vacuum vacuum-formed retainer group.

Informed consent and assent were obtained on the day of deboning. At the deboning appointment following appliance removal (T0), alginate impressions were taken for study models, along with a silicone impression of the mandible arch to obtain study measurements. This silicone impression was cast in hard stone (Type III) in the laboratory on the same day.

The vacuum-formed retainer was made from 120 mm diameter, 0.03-inch thick Essix Ace plastic. A qualified orthodontic technician fabricated it under standardized conditions, using the same technique and machine for each retainer. Fitting occurred within seven days. Patients were instructed to wear it full-time for six months, then at night for six months, and finally on alternate nights

for another six months, per department protocol.

In the bonded retainer group, each tooth was carefully polished using pumice, and scaling was performed if deemed necessary to ensure a clean surface for bonding. A stainless steel coaxial arch wire, 0.0175 inches in diameter, was meticulously shaped to passively fit along the mandible labial segment, extending from one canine to the other. The teeth designated for bonding were etched with a 37% phosphoric acid solution to create a suitable bonding surface, then thoroughly rinsed and dried to eliminate moisture. Following this, an adhesive primer was applied to the etched surfaces and cured to set the foundation for the bonding process. Finally, the shaped wire was securely bonded to each tooth using Transbond LR composite material, ensuring a stable and durable attachment across the mandible anterior segment.

Subjects were monitored at 6, 12, and 18 months with mandible arch impressions taken for measurement. Lost retainers were replaced, and broken retainers were repaired at a daily emergency clinic.

SPSS-23 was used for data analysis. Frequencies and percentages were calculated for categorical variables. Mean and standard deviation were calculated for numerical variables. The chi-square test of association was applied to test the significance of categorical variables, and the Mann-Whitney U test was applied to check the difference between the two means. A P-value less than or equal to 5% is considered significant.

3. RESULTS

A total of 90 patients were included in this study. These 45 patients received bonded retainers (Group A) and 45 patients received vacuum-formed retainers (Group B). The mean age of Group A and Group B was 24.26±4.83 years and 26.42±4.52 years, respectively. (p=0.861). There were 24 (53.3%) males and 21 (46.7%) females in Group A whereas there were 31 (68.9%) males and 14 (31.1%) females in Group B. According to incisor classification, most of the patients in Group A and Group B had class II division I, 16 (35.6%) and 20 (44.4%), respectively. (p=0.711). Most of the patients in Group A and Group B had skeletal pattern II, 23 (51.1%) and 26 (57.8%), respectively. (p=0.750). According to crowding, most of the patients had no crowding in Group A and Group B, 14 (31.1%) and 20 (44.4%), respectively. (p=0.628). The mean amount of crowing in Group A and Group B was 4.31±1.38 mm and 3.91±0.91 mm, respectively. (p=0.104). (Table. No. 1).

According to the treatment performed, in Group A, most of the patients 28 (62.2%) had no extraction, and in Group B, most of the patients 26 (57.8%) had an extraction. (p=0.058). The most common extraction pattern in both groups was first premolar extraction, 23 (51.1%) and 17 (37.8%), respectively. (Table. No. 2).

Table-No: 1

Demographics and clinical profile both the groups

Variable	Group A	Group B	p-value
Age (years)	24.26±4.83	26.42±4.52	0.861
Gender			
Male	24 (53.3)	31 (68.9)	0.130
Female	21 (46.7)	14 (31.1)	
Incisor classification			
Class I	12 (26.7)	8 (17.8)	0.711
Class II Division I	16 (35.6)	20 (44.4)	
Class II Division II	6 (13.3)	5 (11.1)	
Class III	11 (24.4)	12 (26.7)	
Skeletal pattern			
Skeletal I	13 (28.9)	10 (22.2)	0.750
Skeletal II	23 (51.1)	26 (57.8)	
Skeletal III	9 (20.0)	9 (20.0)	
Crowding/spacing (mm)			
Spacing	8 (17.8)	8 (17.8)	0.628
No crowding or spacing	14 (31.1)	20 (44.4)	
Mild	11 (24.4)	9 (20.0)	
Moderate	4 (8.9)	4 (8.9)	
Severe	8 (17.8)	4 (8.9)	
Amount of crowding (mm)	4.31±1.38	3.91±0.91	0.104
Mean±S.D, N (%)			

Table-No:2
Treatment performed at both the study groups

Variable	Group A	Group B	p-value
Extraction summary			
Extraction	17 (37.8)	26 (57.8)	0.058
Nonextraction	28 (62.2)	19 (42.2)	
Extraction pattern			
Firstpremolars	23 (51.1)	17 (37.8)	0.155
Second premolars	7 (15.6)	15 (33.3)	
Asymmetric premolars	9 (20.0)	5 (11.1)	
Others	6 (13.3)	8 (17.8)	
N (%)			

Table-No:3
Variation at 6th, 12th and 18th month of both the study groups

Variable	Group A	Group B	p-value
Little's irregularity index			
At 6th month	0.04±0.01	0.01±0.08	<0.001
At 12th month	0.04±0.01	0.09±0.07	<0.001
At 18th month	0.05±0.02	0.16±0.14	<0.001
Intercanine width			
At 6th month	0.13±0.03	0.25±0.03	<0.001
At 12th month	0.12±0.03	0.25±0.02	<0.001
At 18th month	0.11±0.04	0.24±0.02	<0.001
Intermolar width			
At 6th month	0.37±0.04	0.27±0.06	<0.001
At 12th month	0.35±0.03	0.26±0.05	<0.001
At 18th month	0.36±0.04	0.27±0.06	<0.001
Arch length			
At 6th month	0.24±0.03	0.19±0.02	<0.001
At 12th month	0.22±0.02	0.19±0.02	<0.001
At 18th month	0.23±0.03	0.19±0.02	<0.001
Extraction site space			
At 6th month	0.01±0.01	0.01±0.00	0.594
At 12th month	0.01±0.01	0.01±0.00	0.126
At 18th month	0.00±0.01	0.01±0.00	0.553
Mean±S.D			

The variation at 6th, 12th, and 18 months in both the groups were shown in Table. No. 3. It was seen that Little's irregularity index was relatively high in Group B than in Group A, (p<0.001). Intercanine width was also relatively higher in Group B than in Group A, (p<0.001). But intermolar width was relatively high in Group A than in Group B, (p=<0.001). Arch length in Group A was slightly higher than that in Group B, (p=p<0.001). However extraction site space in Group A and Group had almost the same occurred and the difference was statistically insignificant, (p>0.050). (Table. No. 3).

4. DISCUSSION

This randomized clinical trial evaluated the effectiveness of two retainer types in maintaining mandible incisor alignment up to 6 months post-deboning. Since patients primarily focus on anterior alignment, assessing incisor and canine stability is crucial. However, additional measurements like inter canine width, intermolar width, arch length, and extraction site space opening were also included to comprehensively assess retention effectiveness, following the approach used by Little et al [7] and Rowland et al [11].

In this study Mean age of the bonded retainer group and the vacuum foam retainers group was 24.26±4.83 years and 26.42±4.52 years, respectively. (p=0.861). There were 24 (53.3%) males and 21 (46.7%) females in the bonded retainer group. In the study by O'Rourke et al [12] a higher proportion of female subjects were observed, a trend also noted in prior orthodontic research conducted by Erdinc et al [13] and Andrews [14]. This gender disparity may be attributed to a heightened level of self-awareness and concern for dental health among females, who are generally more proactive in seeking orthodontic care. Additionally, it is thought that females tend to have a greater desire for orthodontic treatment compared to males, which could further explain their predominance in these studies.

Contrary to findings in a previous study conducted by Attack et al [15] not all

subjects demonstrated changes in Little's irregularity index over the 18 months following deboning. However, both treatment groups did exhibit a median increase in Little's irregularity index during the first six months after deboning. This observed increase aligns closely with prior reports conducted by Artum et al [16] and Stormann et al [17] indicating a consistent trend in relapse patterns regardless of the retention protocol or retention type employed.

This study indicated that the bonded retainer was associated with a smaller change in intercanine width during the first 12 months, though the difference was minimal and unlikely to be clinically noticeable. These findings are consistent with the observations of Renkema et al [18] who found that inter canine width remained stable in patients using bonded retainers, indicating effective retention in maintaining the arch dimensions. Similarly, Edman Tynelius et al [19] reported minimal changes in inter-canine width among patients with bonded retainers, further supporting the efficacy of bonded retainers in preserving inter-canine stability over time.

In the first 12 months post-treatment, intermolar width increased slightly more in the bonded retainer group, likely due to the retainer not covering the molar region, relying instead on buccal segment interdigitation for stability. Both groups showed minimal changes, indicating that intermolar width was generally well maintained across retainer types, consistent with other studies [20].

5. CONCLUSION

Bonded retainers have been shown to maintain superior mandibular incisor alignment compared to vacuum-formed retainers during the first six months following debonding, with studies indicating that these retainers provide more stable and consistent positioning of the incisors. Over an extended period of up to 18 months, the alignment achieved with bonded retainers remains largely stable, demonstrating only minimal changes, which supports their effectiveness for long-term retention in maintaining dental alignment post-orthodontic treatment.

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