

COMPARISON OF CLINICAL FAILURES OF LINGUAL RETAINERS BONDED WITH PRIMERLESS FLOWABLE ADHESIVES VERSUS CONVENTIONAL BONDING ADHESIVES

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ABSTRACT

Objective: To compare the frequency of clinical failure of lingual retainers bonded with primerless flowable adhesives and conventional bonding adhesives.

Study Design: Quasi experimental study.

Place and Duration of Study: Department of Orthodontics, Armed Forces Institute of Dentistry Rawalpindi, from Jul 2017 to Jun 2018.

Methodology: As per selection criteria, 76 patients were selected by non-probability consecutive sampling technique. Patients were divided into two groups: the conventional bonding adhesive and the primerless flowable adhesive group with 38 patients in each group. Retainers were bonded using standardized procedure with conventional bonding adhesive in one group and primerless flowable adhesive for bonding in the other group. After bonding of retainers, patients were recalled after 3 months and any bonding failures were recorded.

Results: Failure rate with conventional bonding adhesive was 10.5% while on the other hand, failure with primerless flowable adhesive was 31.6% with a *p*-value of 0.047 which showed a statistically significant difference.

Conclusion: There was a statistically significant difference of clinical failure rate of lingual retainers bonded with conventional bonding adhesive versus primerless flowable adhesive with greater failure rate of the primerless flowable adhesive.

Keywords: Conventional bonding adhesives, Lingual retainer failure, Primer, Primerless flowable adhesives.

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INTRODUCTION

Sustaining the teeth in their final position after orthodontic therapy is probably one of the greatest challenges for the orthodontist since there is a predisposition for relapse resulting in loss of achieved treatment objectives¹.

Retainers are therefore considered an indispensable part of treatment and are necessary to resist this tendency for relapse. For this purpose, lingual retainers are used, which include multistr and wires that with the help of composite adhesives are adhered onto the lingual areas of the lower incisors, resulting in the provision of an effective structure for retention².

Retainers are attached to the tooth surface using composite resin adhesives. The adhesives that are currently being used for bonding to enamel surfaces, have progressed a long way since their inception in the 1950s by Buonocore³. The conventional composites that are frequently used require three steps in placement: an initial step that involves etching of the enamel surface, followed by application of a primer layer, and the final step being placing the adhesive along with light curing. These conventional composites require an

additional step of primer application which causes an increase in the chairside time, makes isolation of the area from saliva more problematic and also increases the expenses involved⁴. Also, primers are likely irritants^{5,6}.

These limitations of conventional composites have compelled researchers to develop newer generation primerless flowable adhesives⁷, which do not require an additional step for priming, thus resulting in the procedure being completed with less chairside time⁸, the number of steps involved in bonding being reduced, sufficient working time, handling of the adhesive being made easier⁹, easier to control and maintain isolation against saliva and also these adhesives provide fluoride release for protection against caries¹⁰. Furthermore, the primer part; which has possible allergic properties, is eliminated in these adhesives.

An *in vitro* study⁷ aiming to assess the shear bond strength values of these materials concluded that primerless flowable adhesives could be used for daily clinical use because of sufficient bond strength. Bazar-gani *et al*, while comparing lingual retainers bonded with or without primer, found failure rate to be on the higher level in the no primer group (27%) when compared to the primer containing group (4%) which was deemed statistically significant by the authors who recommended bonding retainers with primer².

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Evidence on this matter is not substantial since most of the studies are in vitro and are based on bonding of brackets, while fewer studies have been conducted regarding bonding of lingual retainers and therefore further studies are needed in this regard.

This study therefore was designed to compare the lingual retainers bonded with primerless flowable adhesives and conventional bonding adhesive, in terms of early clinical failure.

METHODOLOGY

The study was approved by ethics review committee (ref. no. 905/Trg-ABP1K2) of Armed Forces Institute of Dentistry (AFID). It was a quasi-experimental study where seventy-six patients who had completed orthodontic treatment in AFID were selected on a non-probability consecutive method. Sample size was calculated using WHO sample size calculator. By keeping the level of significance as 5%, power of test as 80%, anticipated population of failure in conventional bonding adhesive group as 0.04 and anticipated population of failure in primerless flowable adhesive group as 0.27, a sample size of 38 was calculated for each group making a total of 76.

Patients between the ages of 13-25 years of age requiring fixed retention, with all anterior dentition present and sound enamel on the lingual surface were included in this study. Exclusion criteria was, patients having malaligned lower incisors with significant marginal ridge discrepancy, rotated canines, spacing, presence of acute gingivitis, and presence of caries or enamel defects.

Informed consent was obtained from the patients. Patients were randomly divided into two groups: the conventional bonding adhesive (n=38) and the primerless flowable adhesive group (n=38). Scaling and polishing of the lingual surface of lower anterior teeth was done 24 hours prior to the application of lingual retainer. The same clinician bonded all the retainers. The retainer wire was gently adapted against the teeth to determine the length required. Isolation was achieved with help of cotton rolls and rapid suction to prevent salivary contamination. Thirty seven percent phosphoric acid (Meta Etchant) was applied for 30 seconds on lingual surface of lower incisors followed by careful rinsing and then air dried. The wire was then adapted against the lingual surfaces and stabilized in position with the help of dental floss.

In the conventional bonding adhesive group, coating of primer (Prime & Bond NT; Dentsply)

was brushed to the inner teeth surfaces and then light cured using LED curing light (3M ESPE Elipar) for 30 seconds. Small amount of composite (Spectrum Dentsply) was then placed on the already primercoated surfaces ensuring maximum coverage of the wire surface followed by light curing using LED curing light with a duration of 30 seconds per tooth.

In the primerless flowable adhesive group, the adhesive (Heliosit Orthodontic; Ivoclar) was directly applied to the lingual surface without any intermediate primer step, ensuring maximum coverage of the wire surface followed by light curing using LED curing light with a duration of 30 seconds per tooth.

Following retainer placement, the patients were given postoperative oral hygiene instructions. The bonded retainer was then evaluated 3 months after placement. Any bonding failures were recorded.

The statistical analysis was carried out using statistical software (version 23; SPSS). Frequency and percentage were calculated for qualitative variables for example gender, failure of retainer. Mean and standard deviation were calculated for quantitative variables like age. Fisher’s exact test was used to compare frequency of failures between the two bonding adhesives. p-value of ≤0.05 was considered as significant.

RESULTS

The study included 76 patients (n=76) among which 40 (52.6%) were female and 36 (47.4%) were male patients. The age of the patients ranged from 13-25 years with an average age of 16.7 ± 3.1 years. Fig-1, shows the scatter of ages along with frequency within the sample.

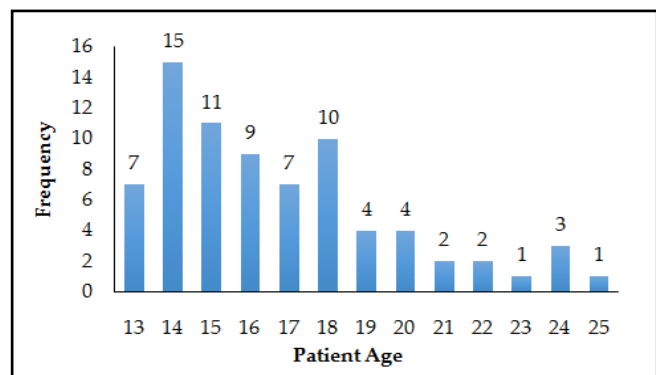


Figure-1: Scatter of ages with frequency within sample.

In the primer-less flowable adhesive group, failure was observed in 12 patients (31.6%). In the conventional bonding adhesive group, the failure was observed in 4 patients (10.5%). Fig-2, showed the frequency

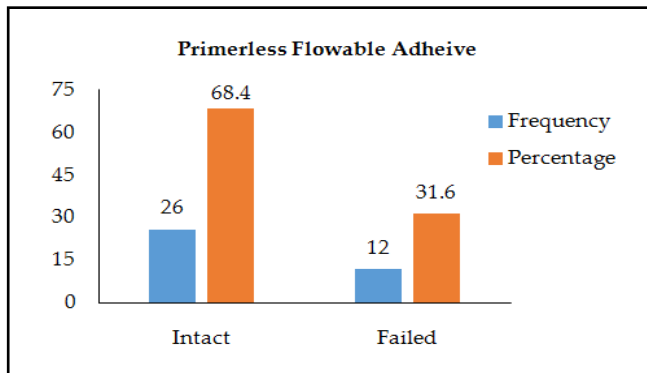


Figure-2: Frequency and percentage of intact and failed retainers in the primer-less flowable adhesive group.

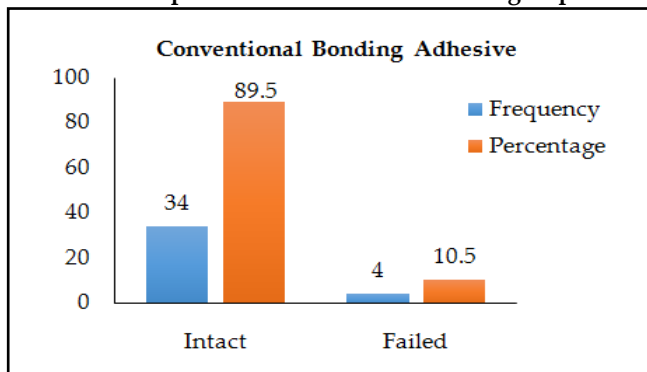


Figure-3: Frequency and percentage of intact and failed retainers in the conventional bonding adhesive group.

and percentage of intact and failed retainers in the primerless flowable adhesive group. Fig-3, displayed the frequency and failure of intact and failed retainers in the conventional bonding adhesive group.

The failure rates between the two groups was compared using Fisher’s exact test, and a *p*-value of <0.05 was considered statistically significant. The *p*-value turned out to be 0.047, thus the null hypothesis is rejected. Results are summarized in table.

Table: Comparison of failure rates of retainers between both groups.

Study Group	Number of Failures (%)	<i>p</i> -value
Primerless Flowable Adhesive (n=38)	12 (31.6%)	0.047
Conventional Bonding Adhesive (n=38)	4 (10.5%)	

DISCUSSION

This study was aimed at comparing lingual retainers bonded with primer less flowable adhesives versus retainers bonded with conventional bonding adhesives, in term of early clinical failure. If proven

that primerless flowable adhesives have failure rates similar to that of conventional bonding adhesives, the use of primer less adhesives can be recommended because of their many favorable clinical characteristics which include, not requiring an additional step for priming and therefore resulting in less chairside time, reduction of the number of steps in bonding, sufficient working time, ease of handling, easier to maintain isolation against saliva¹¹, and also fluoride release for protection against caries. Furthermore, the primer part; which is a potential allergen^{12,13}, is eliminated in the primer less flowable adhesives.

The results of this study showed a high incidence of failure of 31.6% with primer less flowable adhesives and a relatively low incidence of failure of 10.5% with use of conventional bonding adhesives. This proved that there was a significant difference between the clinical failure rates with significantly greater clinical failure of lingual retainers when bonded with primer less flowable adhesives. Hence, the use of primer less flowable adhesives is not recommended for bonding lingual retainers due to the higher incidence of failure rate.

The results of this study coincide with those of Bazargani *et al*², their results demonstrated a greater failure rate of 27% in the no primer group versus a 4% clinical failure rate in the primer containing adhesive group which was statistically significant. This allowed the authors to conclude that the lingual retainers should be bonded with adhesives containing the primer step rather than using primer-less adhesives.

The findings of this study did not coincide with that of Tang *et al*¹⁴. They in a retrospective study compared a chemically cured adhesives with and without these of primers with regards to bracket failure rate. The results were similar with bracket failure rates of 5.62% without primer and 6.22% with primer leading the authors to conclude that fixed appliances can be bonded equally well with or without primers. However, the results were not applicable because firstly, the study by Tang *et al*, used chemically cured adhesives, where as this trial uses light cured adhesives in both groups. Secondly, the retrospective nature of study makes it less reliable as compared to prospective randomization of this trial.

Tang *et al*¹⁵, in another study concluded that lingual retainers can be effectively bonded without the use of bonding resin and therefore contradicting the results of this study. One reason for the difference between the results maybe that the authors compared the

two groups using the same adhesive brand (Transbond LR) with the difference being that in one group the primer step was included, while in the other group the same adhesive was used except that the primer step of bonding was excluded despite the manufacturer's recommendation of using the primer which is included as part of the product. On the other hand, this trial used a conventional adhesive with primer in one group and the other group consisted of an adhesive which is specially designed as a primer-less adhesive.

Rai *et al*⁴, in an in vivo study compared brackets bonded with or without primer resin, demonstrating a similar failure rate between both groups, which does not coincide with the results of this study. However, this study was limited by the fact that the sample size was very limited. Furthermore, this study considered failure rate of brackets rather than that of lingual retainers whereas this study was focused at bonding of lingual retainers.

In vitro studies, comparing shear bond strengths of these adhesives have been carried out. Uysal *et al*¹⁶, compared the shear bond strengths of three primer-less flowable adhesive groups with the conventional bonding adhesives group. The results showed shear bonds strength for the primer-less flowable adhesive group which was considered as just adequate, whereas the conventional bonding adhesive group showed good to excellent shear bond strengths values. These results seem to correspond to the results of this study since it was probable that good shear bond strength would be highly correlated to a reduction in the clinical failure rates of conventional bonding adhesives.

The retainers were evaluated for clinical failure after a follow-up of 3 months. However, clinically for retention purposes, retainer wires are usually kept in place for a minimum of 2 years after completion of orthodontic treatment to maintain proper alignment of teeth and prevent relapse¹⁷. Therefore, further studies on this subject can be undertaken with longer follow-up periods which would allow a more thorough comparison between the clinical failure rates of these two groups of materials.

Additionally, in terms of retainer placement, adapting and bending the retainer wire on the study cast instead of directly bending the wire intra orally would help achieve good adaptation of retainer wire on the lingual surface of anterior teeth, and would ensure that the retainer wire is passive, thus ensuring that no inadvertent tooth movement is caused, and undue stresses are applied on the retainer-wire interface.

Lastly, future studies on this subject may use other brands of primer less flowable adhesives and conventional bonding adhesives. It may be possible that adhesives from other brands may show difference in results due to their unique formulations with relation to filler content, degree of polymerization and other parameters.

CONCLUSION

A statistically significant difference was found between the clinical failure rates of lingual retainers bonded with primer less flowable adhesives versus conventional bonding adhesives with a significantly increased clinical failure rate of lingual retainers which are bonded with primer less flowable adhesives. Therefore, based on the results of this study, it is recommended to use conventional bonding adhesives for the bonding of lingual retainers due to their reduced clinical failure rate, despite the many advantages of avoiding the primer step when bonding with primer less flowable adhesives.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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