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CERAMIC BRAKETS BONDING USING LIGHT-CURED GLASS IONOMER ADHESIVE: A CLINICAL STUDY

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ABSTRACT:

The purpose of this study was to evaluate the use of light-cured glass ionomer adhesive (Fuji Ortho LC) for bonding Ceramic brackets with and without etching of enamel. Eighteen cases (8 males and 10 females) with full permanent dentition were selected to participate in this study. Their mean age was 13.64±1.48 years. For all subjects, the maxillary right and mandibular lelft quadrants were bonded with acid etching and considered as Group I (Etch Group). While, the maxillary left and mandibular right quadrants were bonded without acid etching and considered as Group II (Non-etch Group). A total of 274 teeth were bonded, equally divided 137 teeth for each group. Bond failure frequencies were recorded. The percentage of bond failure in Group I (Etch Group) was 2.2% while, in Group II (Non-etch Group) was 3.7%. Chi-Square statistical test showed no significant difference in bond failure rates between both groups. The overall successful bonding rate was 97.1%. The light-cured glass ionomer (Fuji Ortho LC) is a satisfactory adhesive for direct bonding of Ceramic brackets either with or without etching of the enamel.

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INTRODUCTION

Orthodontic bonding agent must have sufficient strength to withstand the forces applied throughout the treatment period, yet easy to debond causing no harmful effects to the unreparable enamel surfaces and easy for the clean up procedure at the end of treatment. Many patients complained of post-treatment enamel discoloration after the use of the conventional composites for brackets bonding.

The introduction of glass ionomer cement by Wilson and Kent[1] for conservative dentistry has encouraged many orthodontists to use it instead of composite resin for bonding. Glass ionomer cement has two important advantages of great concern to the orthodontic practitioners. These are the ability to chemically bond to enamel, in addition to this its ability to act as a reservoir of fluoride ions and can be recharged by fluoridated toothpaste thus minimizing the possibility of enamel decalcification during treatment.

Compton et al[2] in their invitro study compared the shear bond strength of stainless steel orthodontic attachments to enamel with both chemically and light cured glass ionomer orthodontic adhesives. They concluded that light-cured glass ionomer adhesive has a greater shear bond strength than that of chemically cured glass ionomer at 1 and 24 hours post bonding.

Kusy[3] discussed the damage to the teeth when debonding techniques are used for removing composite bonding resins. He strongly recommended the use of glass ionomer cements for orthodontic bonding because these cements do not need etching or cause damage to enamel during debonding.

Fricker[4] in a 12-month clinical study compared the use of light activated glass ionomer cement with the standard composite resin for bonding orthodontic brackets. He found no significant difference in failure rates between light-cured glass ionomer (3.3%) and the conventional (System 1 + Ormco Corp.) bonding composites (1.6%).

Rock and Abdullah[5] in an invitro study compared bond strengths produced by composite resin and compomer light-cured orthodontic adhesives. They concluded that the compomer bond strength lies within the range considered being clinically acceptable.

Bishara et al[6] in an invitro study evaluated acid etching, water wetting and salivary contamination prior to the use of light-cured reinforced glass ionomer adhesive. They concluded that there were no significant differences existed among groups that had the enamel surface etched before bonding, regardless of the adhesive used or the enamel surface contamination with water or saliva. Enamel etching is a critical variable that affects bond strength as well as bond failure location when using this glass ionomer.

Fricker[7] tested self-curing resin modified glass ionomer cement. In a 12-month clinical evaluation of this adhesive for bonding metal orthodontic brackets, he concluded that Fuji Ortho is a satisfactory adhesive for the direct bonding of orthodontic brackets where there is no occlusal interference.

The purpose of this clinical study is to evaluate the use of light-cured glass ionomer adhesive for bonding ceramic brackets with and without acid etching of enamel.

MATERIALS & METHODS

Eighteen cases were selected to participate in this study (8 males and 10 females). All attended to Dr. Soliman Fakeeh Hospital, Jeddah, K.S.A. seeking orthodontic treatment. All subjects ranged from 11.67 years to 16.16 years with a mean age of 13.64 years (SD ± 1.48), all with full permanent dentition (Table 1).

Complete orthodontic records were done for each patient and a treatment plan was established. The range of malocclusion covered Class I, Class II and Class III. Seven cases of the eighteen selected were treated by non-extraction; two of them were only single arch cases. The remaining eleven were treated by extraction of four first premolars.

Full fixed orthodontic appliances were used of the same brand of brackets for all the cases, 0.022 inch slot Roth ceramic brackets. Ceramic brackets were used to ensure light penetration and complete adhesive cure. Only the upper anterior teeth, upper premolars and lower anterior teeth were included in this study. The upper molars, lower premolars and molars were bonded with the conventional bonding composites.

For all subjects the maxillary right and mandibular left quadrants were bonded with acid etching and considered as group I (Etch group),while the maxillary left and mandibular right quadrants were bonded without acid etching and considered as group II (Non-etch group). This procedure was done only to minimize the inter-subjects variables.

Bonding Procedure:

1- The teeth were pumiced with a rubber cup and a low speed hand piece then rinsed thoroughly.

2- Isolation: isolation was done using cheek retractors, tongue shield and cotton rolls.

3- Etching and Non-etching:

- **Group I (Etch group):** Teeth were then dried and etched for 10 seconds using 10% polyacrylic acid (Fuji dentine conditioner), then washed for 15 seconds and left slightly wet.
- **Group II (Non-etch group):** No etch was done and the teeth were left slightly wet after pumicing.

4- Ceramic brackets were then treated using silane-compling agent using a small brush before applying the adhesive.

5- Fuji LC was then mixed according to the manufacture's recommendations for 1 minute then loaded in CR syringe. A small amount of the mix placed over bracket pad and then bracket was positioned on the bracket site with firm pressure. Each mix was used for bonding only three brackets, and then excess materials removed with an explorer.

6- Light curing: each bracket was light cured for 20-40 seconds with a 470mm. wavelength device.

7- A layer of petroleum jelly was placed on the bracket bonded to reduce the hydration during setting.

8- Cheek retractors and cotton rolls were removed 6 minutes after the last bracket had been bonded. First archwires (0.124" Nitinol) were tied at least 20 minutes after bonding the last bracket.

9- Patients were given written instructions for oral hygiene care and appliance maintenance. These instructions were intended to minimize the possibility of bracket failure due to a patient cause.

Bracket bonding failure:

The patients were observed during their orthodntic visits evey four weeks for any loose or missing brackets. Failure of brackets bonding was monitored and recorded over the whole treatment period and another new bracket was bonded again using the same bonding agent used at the initial procedure.

Statistical Analysis:

Descriptive statistics including mean, standard deviation and minimum and maximum were calculated. Z-test was applied to the difference between the proportions to identify significant differences between Etch and Non-etch groups.

Percentages of bond failure in each group were determined by using Z-test.

For statistical analysis Chi-square test was used to compare the results obtained in the two groups.

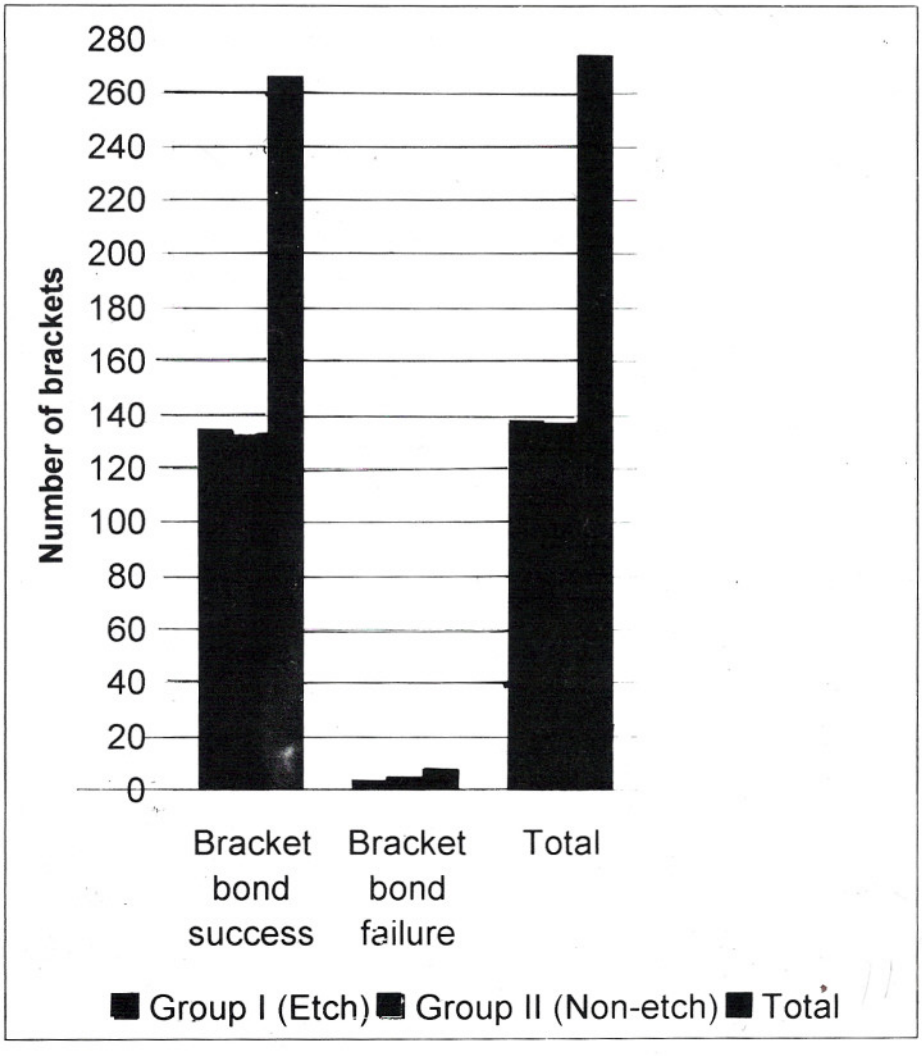
Table I: Age distribution of the selected sample

	Number	Minimum	Maximum	Mean	SD
Male	8	11.67 Yrs.	15.25 Yrs.	13.00 Yrs.	1.17
Females	10	11.92 Yrs.	16.16 Yrs.	14.16 Yrs.	1.55
Total	18	11.67 Yrs.	16.16 Yrs.	13.64 Yrs.	1.48

Table II: Brackets number, frequency of bond failure and success rate in Group I (Etch Group) and Group II (Non-etch Group).

Brackets bond	Group I (Etch)		(Group II (Non-etch)		Total	
	No.	%	No.	%	No.	%
Success	134	97.8	132	96.4	266	97.1
Failure	3	2.2	5	3.6	8	2.9
Total	137	100	137	100	274	100

P-Value = 0.7


Number of brackets
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Bracket bond success
Bracket bond failure
Total
Group I (Etch)
Group II (Non-etch)
Total

RESULTS

During the treatment period (two years and two months) brackets failure was recorded for each group. In group I (Etch Group) only 3 failures out of 137 brackets (2.2%) were recorded while in group II (Non-etch Group) 5 failures (3.7%) were recorded out of the 137 brackets. The Z-test showed no significant difference between Etch and Non-etch groups (P-value = 0.7).

The overall success rate of Ceramic bracket bond was 97.1% for both Etch and Non-etch groups.

DISCUSSION

Many clinical studies have been reported using this light-cured glass ionomer for bonding orthodontic brackets. The present study showed a relatively low failure rate in both groups (Etch and Non-etch) with the use of light cured glass ionomer adhesive for bonding ceramic brackets. The overall failure rate is only 2.9%, which is a reasonable percentage that encourages the use of this adhesive for orthodontic bonding. Although this rate of failure is higher than that for the conventional composites as reported in many previous studies[5,9,10], still it has many advantages that outweight this relatively higher failure rate.

The non-etch group showed a non-significant higher failure rate than the etch group. These results seem to be in accord with the results obtained by Dasch et al[8], who found also a non-significant higher failure rate for non-etched enamels. A conflict was found between the results of the invitro study of Bishara et al[6] who found a significant difference in bond strength between etched and non-etched surfaces with the use of the same type of light-cured glass ionomer orthodontic adhesive. According to Zachrisson[4] we should be cautious in dealing with the laboratory findings compared to clinical work. A great disagreement was found between the results of Miguel et al[10] and the results obtained in this

study. The failure rate of glass ionomer cement in Miguel's study was 50.89% while the failure rate in this study for etching group was only 2.2%. This high difference could be attributed to the difference in brand of the material used. The adhesive used in this study was light-cured resin reinforced orthodontic glass ionomer cement, while the adhesive used in Miguel et al[10] study was a chemical cure glass ionomer luting cement.

Bracket failure rate in Fricker's[4] study was 3.3%. This rate can be compared only with the failure rate in Etch group (2.2%) of the present study, as he used etching before bonding. This difference could be attributed to a difference in light penetration during the curing process between the metal brackets used by Fricker and the ceramic brackets used in this study. Full curing was ensured with the use of ceramic brackets, which will be reflected upon the bond strength. Comparing the results of Silverman et al [11]could be done only with the result obtained in group II of the present study. Silverman et al did not use etching with the use of the same light-cured glass ionomer cement. They obtained a success rate of 96.8% during an 8-month period of clinical testing while the success rate of Non-etch group in the present study is 96.4%. This slight difference could be resorted to the shorter treatment test period of Silverman et al.

CONCLUSION

The light-cured glass ionomer (Fuji Ortho LC) is a quite satisfactory adhesive for direct bonding of ceramic brackets either with or without etching of the enamel.

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