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ORTHODONTIC BRACKETS;
COMPARISON OF SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS BONDED TO COMPOSITE SURFACE

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ABSTRACT.... Introduction: Bracket bonding on filled tooth surfaces is sometimes required in clinical orthodontic practice. The objective was to compare mean shear bond strength (SBS) of metal brackets on diamond bur roughened versus no treatment composite surfaces**. Study Design:** In Vitro, Comparative study. **Period:** January 2017 to October 2017. **Setting:** Orthodontic Department**,** Faisalabad Medical University. **Materials & Methods:** 30 extracted human premolars were used. They were randomly divided into two groups of 15 teeth. In group-I, metal brackets were bonded to composite with no surface treatment. In group-II, brackets were bonded after roughening composite surface with diamond bur. SBS was measured using universal testing machine. **Results:** SBS of metal brackets bonded with no surface treatment was significantly lower than diamond bur roughened group. **Conclusion:** Composite surface treatment with diamond bur roughening increased shear bond strength of orthodontic brackets.

Key words: Brackets; Composite; Diamond; Shear Bond Strength.

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INTRODUCTION

Today, with increase of adult orthodontic patients, it is very common to find in adults, or even in younger patients, restorations of composite resins,[1] this clinical predicament demands the requirement of different techniques to improve shear bond strength (SBS) between composite restoration and bracket by special surface preparation.[2]

According to literature, brackets bonded to the enamel must have shear bond strength between 6 and 8 MPa[3-5] in order to achieve successful orthodontic bonding.

In relation to amalgam and porcelain surfaces, studies showed that amalgam surfaces treated with laser or sandblaster produced higher SBS.[6,7] 4-META used as primer is also said to increase the SBS closer to etched enamel teeth with amalgam surfaces roughened with air-borne particle abrasion.[8] Sandblasting is used successfully to bond metal brackets on porcelain surfaces being safe than hydrofluoric acid etching.[9] Bur roughened amalgam surface also showed increased SBS values.[8,10,11]

The literature is lacking regarding best surface treatment method for composites to get maximum SBS while orthodontic bonding.[10] Results of present study will guide orthodontists for quality orthodontic practice with lesser bond failures on composite surfaces. Therefore objective of our study was to compare mean shear bond strength of metal brackets on diamond bur roughened versus no treatment composite surfaces. Our hypothesis was that there is no difference in mean SBS on composite surface with diamond bur roughening versus no treatment.

As literature is sparse so this study was conducted to compare SBS of metal brackets on bonding to composite surface treated with no treatment or diamond bur roughening. The hypothesis was rejected as the SBS of metal brackets bonded with no surface treatment was significantly lower than diamond bur roughening. The values of both the groups in present study are found in the range of recommended bond strength (6-8 MPa).[3-5]

METHODS

Study Design
In vitro, comparative study.

Setting
Orthodontic department, Faisalabad Medical University.

Sample Size
A sample size of 10 in each group was calculated to have more than 80% power detecting a difference of 7.45 MPa between mean values.[12]

Sampling Technique
Non-probability purposive sampling

SAMPLE SELECTION

Inclusion Criteria
Extracted premolars having intact buccal surface

Exclusion Criteria
Extracted teeth with fracture, caries, enamel hypoplasia, etc

Data Collection Procedure
According to selection criteria and after ethics approval, 30 instead of 20 extracted premolar teeth were included from the Exodontia department of our institute and were kept in 0.1% (wt/vol) thymol solution. All teeth were embedded perpendicularly in self cure acrylic moulds, filled buccally with composite restorations (Tetric Evo-ceram, Ivoclar Vivadent AG, Schaan) with similar standardized protocol and polished with pumice. Teeth were randomly allocated into 2 groups following random number table method. Group I 10 teeth was provided no surface treatment while Group II 10 teeth were diamond bur roughened. Metal premolar brackets (Discovery, Dentaurum, Germany) with bracket base area of 10.3 mm^2 were bonded to each composite surface after etching, with primer and adhesive (Transbond XT, 3M Unitek, Monrovia, USA). Samples were stored in normal saline for 72 hours, and thermo cycled for 24 hours.

The bonded teeth were then tested on universal testing machine @1mm/min. The SBS was measured in Newton's and then converted in MPa using the formula: Shear strength (MPa) = Debonding force (N)/bracket base area (mm^2) and 1 N/mm.[9]

Data Analysis Procedure
Data collected was analyzed by using computer software SPSS version 20.0. The SBS was presented in the form of mean, standard deviation and t-test was applied for comparison of SBS between the two groups. Statistical significance was defined at $\alpha=0.05$.

RESULTS
The mean and standard deviation values for the SBS of two groups are presented in the Table-I and II.

	n	Mean	Standard deviation	Std. Error Mean
Shear bond strength (Mpa)	10	6.6900	2.34768	1.27900

Table-I. Descriptive statistics

	n	Mean	Standard deviation	Std. Error Mean
Shear bond strength (Mpa)	10	10.5723	2.7245	0.42456

Table-II. Shear bond strength of diamond bur group

The t-test comparison indicates that there is a significant difference between the two groups ($P<0.05$). The diamond roughened group has significantly higher SBS than the no treatment group (Table-III).

	t-test						
						95% Confidence interval of the Difference	
	t	Df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Shear bond strength in MPa	4.678	56	.000	4.28009	1.68945	2.46789	6.45788

Table-III. Comparison of both the groups

DISCUSSION

Literature is there regarding amalgam surface treatment methods before orthodontic bonding, these methods includes use of diamond bur roughening, green stone, metal primers, and sandblasting technique.[13-19] Bourke suggested use of hydrofluoric acid to increase the bond between porcelain and brackets,[20] however, this procedure is not justified on the resin surface, because the hydrofluoric acid is specific for ceramic surfaces which are vitreous and different from resinous composite surfaces.[3,21]

Because orthodontic and operative composite materials resins have similar compositions, the method for bonding brackets on composite surfaces is the same as the procedure of repair of restorative composite resins. Studies about composite filling repair[22,23] suggest that composite surface treatments with diamond burs present SBS superior to surfaces with no treatment, as confirmed in the current study.

The highest SBS of metal brackets bonded on composite surfaces roughened with diamond bur could be due to the fact that the mechanical abrasion increased surface roughness, which subsequently improved the micromechanical interlocking.[24-26] These results are in agreement with couple of other studies[11,12] but in contrast with few studies that have reported that sandblasting creates the highest SBS for composite.[27-29] The study was conducted in vitro and factors[30] like bonding surface, surface topography, bonding area, method of bracket placement and application of shear force may complicate assessment of best bonding protocol. Therefore, it is suggested that the shear bond strength of metal brackets bonded to composite be calculated in vivo situations.

CONCLUSION

Composite surface treatment with diamond bur roughening increased shear bond strength of metal orthodontic brackets

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Muhammad Azeem	Conceiving the study, data recording, analysis and interpretationof data.	
2	Arfan ul Haq	Data recording and analysis, written the manuscript.	
3	Javed Iqbal	Designing the study, Critically reviewed the manuscript.	