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ORIGINAL RESEARCH

Analysis of shear bond strength of brackets systems having different base technologies

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ABSTRACT

Background: The bond strength of orthodontic brackets is a critical factor in the success of orthodontic treatment. The present study compared shear bond strength of brackets systems having different base technologies.

Materials & Methods: 50 extracted first maxillary premolars were divided into 2 groups of 25 teeth each. Group I had Master Series™ conventional twin photochemically etched 80-gauge mesh, and group II had Victory series™ conventional twin 80-gauge woven mesh bonding base. All teeth were bracketed using an acid-etch composite system, and the SBS measured using an instron universal testing machine.

Results: The mean shear bond strength in group I was 8.32 MPa, and in group II was 9.46 MPa. The difference was significant (P< 0.05).

Conclusion: Victory series™ conventional twin 80-gauge woven mesh bonding base had the highest bond strength.

Key words: Shear bond strength, self-ligating brackets, universal testing machine

INTRODUCTION

The bond strength of orthodontic brackets is a critical factor in the success of orthodontic treatment. It refers to the ability of the adhesive used to attach the brackets to the teeth to withstand the forces applied during orthodontic treatment.[1] Several factors influence the bond strength, including the type of adhesive, the surface preparation of the enamel, the type of bracket, and the curing method. In orthodontics, bond strength of orthodontic brackets is a crucial factor. The primary component in the development of bonding materials that needs to be taken into consideration is shear bond strength (SBS).[2] The fact that the unit of bond strength was pounds per square inch rather than the modern standard Mega Pascal (MPa) is an intriguing observation. One MPa is equivalent to 145.038 pounds of force per square inch. The orthodontic bracket's bond strength needs to be strong enough to endure the forces used during orthodontic therapy.[3]

The orthodontic brackets' bond strength is determined by a number of factors. These consist of the bracket base's dimensions and configuration. The attachment needs to be esthetic, strong enough to endure masticatory loads, easy to remove at the conclusion of therapy, and able to apply orthodontic forces.[4] Since enamel and resin do not chemically attach to bracket bases, efforts have been made to increase mechanical retention. The brackets and bases have become smaller, among other things, as a result of the growing need for a more aesthetically pleasing metal-bonded appliance.[5] The present study compared shear bond strength of brackets systems whaving different base technologies.

MATERIALS & METHODS

The present study consisted of 50 extracted first maxillary premolars. The teeth were divided into 2 groups of 25 teeth each. Group I had Master Series™ conventional twin photochemically etched 80-gauge mesh, and group II had Victory series™ conventional twin 80-gauge woven mesh bonding base. All teeth were bracketed using an acid-etch composite system, and the SBS measured using an instron universal testing machine at a crosshead speed of 2 mm/min. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of brackets

Groups	Group I	Group II
Material	Photochemically etched 80-gauge mesh	woven mesh bonding base
Teeth number	25	25

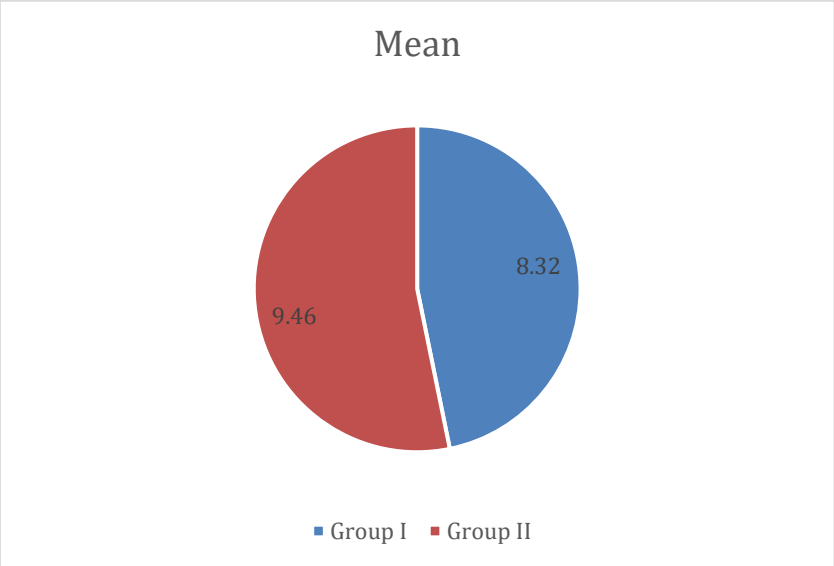
Table I shows that group I had Master Series™ conventional twin photochemically etched 80-gauge mesh, group II had Victory series™ conventional twin 80-gauge woven mesh bonding base. Each group had 25 teeth.

Table II Comparison of shear bond strength

Groups	Mean	P value
Group I	8.32	0.041
Group II	9.46	

Table II, graph I shows that mean shear bond strength in group I was 8.32 MPa, and in group II was 9.46 MPa. The difference was significant ($P< 0.05$).

Graph I Comparison of shear bond strength



DISCUSSION

Shear bond strength is dependent on a number of variables, such as the bonding materials' adhesive qualities, the attachment at various interphases, such as the interphase between the composite and the bracket, and the polymerization of the composite bonding material.[6,7] The bracket base has a mechanical undercut that allows the orthodontic adhesive to spread out prior to polymerization. The majority of metal brackets can be retained by using a tiny brazed mesh. Some bracket bases are sintered with porous metal powder, sandblasted, chemically etched, or have an undercut that has been machined.[8] Research has shown that bond failure can happen at the resin–bracket base interface, within the resin, or between the enamel-bonded metal brackets with a mechanical interlock and a 15-second acid etching period. However, there was relatively more bond failure between the resin and bracket because of stress concentration and defects in the resin film.[9] The present study compared shear bond strength of brackets systems with different base technologies.

We found that group I had Master Series™ conventional twin photochemically etched 80-gauge mesh, group II had Victory series™ conventional twin 80-gauge woven mesh bonding base. Each group had 25 teeth. In order to compare, Odegaard et al[10] used 120 cow teeth that were bonded with two different kinds of metal brackets and a brand-new ceramic bracket. There were two types of adhesives used: a paste/paste adhesive and a so-called no-mix glue. For both adhesives, the ceramic bracket's shear bond strength was determined to be superior. The enamel/adhesive contact of the ceramic bracket was the primary site of bond failure, whereas the bracket/adhesive interface of the metal bracket was the primary failure site. It is determined that the bond strength in shear mode between the adhesive and the ceramic bracket is stronger than the bond strength between the adhesive and the enamel.

We observed that mean shear bond strength in group I was 8.32 MPa, and in group II was 9.46 MPa. Following thermocycling, Faltermeier et al[11] examined the shear bond strengths and adhesive remnant index (ARI) scores of adhesives consisting of one, two, and three components. Five adhesives were used to affix fifty stainless steel brackets (10 per adhesive group) to the removed third molars. RelyX Unicem, a one-component adhesive from 3M Espe in Seefeld, Germany, was used in Group 1. Maxcem, a one-component adhesive (Kerr, Orange, Calif.) was used in Group 2. Group 3 consisted of Multilink (Ivoclar-Vivadent, Schaan, Liechtenstein), a self-conditioning two-component adhesive solution. Group 4 consisted of a two-component adhesive solution consisting of Transbond XT adhesive (3M

Unitek, Monrovia, Calif.) and Transbond Plus primer (self-etching). Group 5 (control group) used a standard three-component adhesive system made composed of 3M Unitek's XT glue, Transbond XT primer, and etchant. Prior to shear bond strength testing and evaluation using the ARI, all samples underwent thermocycling (6000 x 5 degrees C/55 degrees C) in a mastication device. The shear bond strengths of the two and three component adhesive systems did not significantly differ from one another. RelyX Unicem and Maxcem, two 1-component adhesives, showed significantly lower shear bond strengths than 2- and 3-component systems. There were no discernible variations between the groups according to the ARI scores.

When Bishara et al[12] used a traditional adhesive system to examine the bond strengths of an acidic primer and composite resin, they discovered that the mean bond strengths were 11.8 MPa and 10.4 MPa, respectively. Self-etching primers have SBSs that range widely, from 2.8 MPa to 16.6 MPa. There were no appreciable variations in SBS between 6.82 and 12.35 mm2 bracket bases, according to MacColl et al.[13] Nevertheless, they discovered that a statistically significant decrease in SBS occurred when the surface area was reduced to 2.38 mm2. It is conceivable that this decline would have clinical importance.

Chaudhary et al[14] compared the shear bond strength (SBS) of brackets systems with four different base technologies. Maxillary first premolars were randomly divided into four groups of thirty specimens each: (1) Master Series™ conventional twin, (2) T3™ self-ligating, (3) Victory series™ conventional twin, and (4) H4™ self-ligating brackets. The overall mean bond strengths were 8.49 ± 2.93, 10.85 ± 3.34, 9.42 ± 2.97, and 9.73 ± 2.62 for the Groups 1, 2, 3, and 4 brackets, respectively. One-way ANOVA test gave an $F = 3.182$ with a $P = 0.026$. The Group 1 and Group 2 were observed to have statistically significant difference with a $P = 0.014$.

CONCLUSION

Authors found that Victory series™ conventional twin 80-gauge woven mesh bonding base had the highest bond strength.

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