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# Original Article

## A comparison of shear bond strength of brackets systems with different base technologies

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***ABSTRACT:***
**Background:** Bond strength of orthodontic brackets is an important consideration in orthodontics. Shear bond strength (SBS) is the main factor, which has to be concerned in the evolution of bonding materials. The present study was conducted to compare shear bond strength (SBS) of brackets systems with different base technologies. **Materials & Methods:** 90 extracted caries-free first maxillary premolars were divided into 3 groups of 30 teeth each. 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 and group III had H4™ self-ligating brackets with Treadlok™ base T the SBS was measured using an Instron Universal Testing Machine. **Results:** The mean shear bond strength in group I was 8.42 MPa, in group II was 9.40 MPa and in group III was 9.72 MPa. The difference was significant (P< 0.05). **Conclusion:** The H4™ self-ligating brackets with Treadlok™ base T had the highest bond strength.
**Key words:** Bond strength, orthodontic brackets, self-ligating brackets

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## INTRODUCTION

Bond strength of orthodontic brackets is an important consideration in orthodontics. Shear bond strength (SBS) is the main factor, which has to be concerned in the evolution of bonding materials.[1] An interesting observation is the unit of bond strength being pounds per square inch compared with today's standard unit, Mega Pascal (MPa).[2] The normal conversion would be 1 MPa =145.038 lbs force per square inch. The bond strength of the orthodontic bracket must be able to withstand the forces applied during the orthodontic treatment.[3]

Numerous factors influence the bond strength of orthodontic brackets. These include the size and design of the bracket base. The attachment must be able to deliver orthodontic forces, withstand masticatory loads, be esthetic, and be easy to remove at the end of treatment.[4] Bracket bases do not bond chemically to enamel or resin; therefore, efforts have been made to improve mechanical retention. The increasing demand for a more esthetic metal-bonded appliance has led to, among other things, a reduction in the size of the brackets and their bases. However, the smaller retentive area of the bracket base influences bond strength.[5]

An evaluation of the performance of fine-mesh, coarse-mesh, and undercut bracket bases found that the fine-mesh base had higher tensile bond strength than the coarse-mesh base, and both performed better than the undercut base. Additional studies involved the evaluation of a variety of bracket base designs including 60, 80 and 100 gauges (0.093, 0.123, 0.154 inches, respectively) single-mesh bases, a double-mesh base, and integrated metal base.[6] The present study was conducted to compare shear bond strength (SBS) of brackets systems with different base technologies.

## MATERIALS & METHODS

The present study comprised of 90 extracted caries-free first maxillary premolars. The teeth were divided into 3 groups of 30 teeth each. 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 and group III had H4™ self-ligating brackets with Treadlok™ base. Maxillary first premolars 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 assessed statistically. P value less than 0.05 was considered significant.

## RESULTS

**Table I Distribution of brackets**

| Groups | Group I | Group II | Group III |
|---|---|---|---|
| Material | Photochemically etched 80-gauge mesh | woven mesh bonding base | Treadlok™ base |
| Teeth | 30 | 30 | 30 |

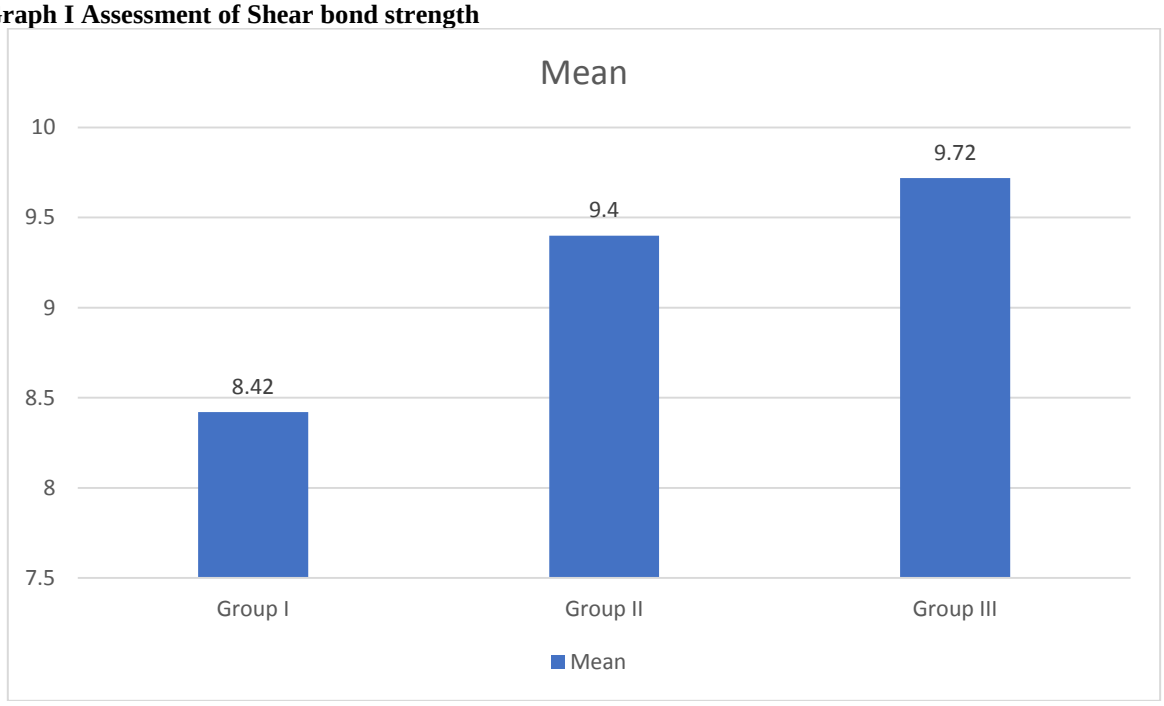
Table I shows that group I comprised of Master Series™ conventional twin photochemically etched 80-gauge mesh, group II had Victory series™ conventional twin 80-gauge woven mesh bonding base and group III had H4™ self-ligating brackets with Treadlok™ base. Each group had 30 teeth.

**Table II Assessment of Shear bond strength**

| Groups | Group I | Group II | Group III | P value |
|---|---|---|---|---|
| Mean | 8.42 | 9.40 | 9.72 | 0.02 |

Table II, graph I shows that mean shear bond strength in group I was 8.42 MPa, in group II was 9.40 MPa and in group III was 9.72 MPa. The difference was significant (P< 0.05).

**Graph I Assessment of Shear bond strength**




## DISCUSSION

Shear bond strength depends on various factors, including the adhesive properties of the bonding materials, the attachment at the different interphases like the tooth to composite interphase and the composite to bracket interphase, as well as the polymerization of the composite bonding material.[7] A mechanical undercut in the bracket base provides a place for the orthodontic adhesive to extend before polymerization. Retention of most metal brackets is achieved with a fine-brazed mesh. Other bracket bases have a milled undercut or are sandblasted, chemically etched, or sintered with porous metal powder.[8] Studies have indicated that bond failure in enamel-bonded metal brackets with a mechanical interlock and 15 seconds of acid-etching time occurs at the resin–bracket base interface, within the resin itself, or between the resin and enamel. 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 was conducted to compare shear bond strength (SBS) of brackets systems with different base technologies.

In present study, group I comprised of Master Series™ conventional twin photochemically etched 80-gauge mesh, group II had Victory series™ conventional twin 80-gauge woven mesh bonding base and group III had H4™ self-ligating brackets with Treadlok™ base. Bishara et al[10] compared bond strengths of an acidic primer and composite resin with a conventional adhesive system and found mean bond strengths of 10.4MPa and 11.8MPa, respectively. The SBSs of self-etching primers can vary widely, ranging from 2.8MPa to 16.6MPa.

We found that mean shear bond strength in group I was 8.42 MPa, in group II was 9.40 MPa and in group

III was 9.72 MPa. MacColl et al[11] found no significant differences in SBS between 6.82 and 12.35 mm2 bracket bases. However, they found that reduction of the surface area to 2.38 mm2 resulted in a statistically significant drop in SBS. It can be speculated that this drop would be of clinical significance.

Faltermeier et al[12] compared the shear bond strengths and the adhesive remnant index (ARI) scores of 1-, 2-, and 3-component adhesives after thermocycling. Fifty stainless steel brackets (10 per adhesive group) were bonded to extracted third molars with 5 adhesives. Group 1 was a 1-component adhesive, RelyX Unicem (3M Espe, Seefeld, Germany). Group 2 was a 1-component adhesive, Maxcem (Kerr, Orange, Calif). Group 3 was a self-conditioning 2-component adhesive system, Multilink (Ivoclar-Vivadent, Schaan, Liechtenstein). Group 4 was a 2-component adhesive system, Transbond Plus primer (self-etching) and Transbond XT adhesive (3M Unitek, Monrovia, Calif). Group 5 (control group) was a conventional 3-component adhesive system consisting of an etchant, Transbond XT primer, and XT adhesive (3M Unitek). All samples were thermocycled (6000 x 5 degrees C/55 degrees C) in a mastication device before shear bond strength testing and evaluation with the ARI. No significant differences of shear bond strength between the 2- and 3-component adhesive systems were found. Significant decreases of shear bond strength were observed with 1-component adhesives, RelyX Unicem and Maxcem, compared with 2- and 3-component systems. The ARI scores indicated no significant differences between the groups.

Odegaard et al[13] took one hundred twenty bovine teeth bonded with two types of metal brackets and a new ceramic bracket for comparison. Two different adhesives were used, a so-called no-mix and a paste/paste adhesive. The shear bond strength of the ceramic bracket was found to be superior for both adhesives. Bond failure with the ceramic bracket occurred predominantly in the enamel/adhesive interface; the failure site for the metal bracket was mainly in the bracket/adhesive interface. It is concluded that the bond strength between the ceramic bracket and the adhesive in shear mode is stronger than that between the adhesive and the enamel.

## CONCLUSION

Authors found that the H4™ self-ligating brackets with Treadlok™ base T had the highest bond strength.

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