

## Shear Bond Strength of Two Light Cure Composites after Thermocycling

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### Abstract

**Aim:** Application of light cure composites has become very popular in orthodontics. The aim of this study was to compare shear bond strength (SBS) of Ideal Maccuo and Vit L-essence light cure composites in bracket bonding after thermocycling.

**Materials and Methods:** 100 intact freshly extracted upper first premolars were randomly assigned into four equal groups. In the first and second group Vit L-essence composite was applied to the bracket base and transferred to buccal enamel surface and cured for 40 seconds. In the third and fourth group Ideal Maccuo composite was used for bracket bonding. After 24 hours the teeth in the first and third group were thermocycled between 5 to 55°C and then debonding was performed by Zwick testing machine. The mean shear bond strength of four groups was compared by ANOVA test.

**Results:** There was no significant difference between Vit L-essence and Ideal Maccuo composite either before or after thermo cycling. SBS also did not differ significantly before and after thermo cycling in each single group.

**Conclusion:** It was concluded that: 1-Thermocycling did not affect the SBS of Vit-Lessence and Ideal Maccuo composite in bracket bonding. 2- There was no significant difference in SBS of Vit L-essence and Ideal Maccuo composite either before or after themocycling (IJO 2006;1:168-71).

**Keywords:** Light cure, Thermocycle, Shear bond strength

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In comprehensive orthodontic treatment force is applied through fixed appliances to the teeth. Today attaching the brackets to the teeth is performed via direct bonding with acid etch technique<sup>1</sup>. This method has numerous advantages such as esthetic, chair time reduction, less complexity and more patient comfort.

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In spite of the vast majority of adhesives which are used for this purpose we still confront spontaneous debonding of 5-7% bonded brackets during treatment. This might be due to adhesive or conditioner type, etching duration, nutritional habits, type of the food, oral environment.<sup>2,9</sup>

To overcome bonding problems the use of light cure adhesives has been suggested in orthodontics, since by these kinds of adhesives accurate bracket positioning and complete removal of composite remnants before curing is possible. This method has become the method of choice for many clinicians. Another interfering factor which decreases bond strength is thermal changes in oral environment. Ferracane<sup>10</sup> has shown that there is 20-30% reduction in shear

bond strength of composites after 1 day, 6, 12 and 24 months in 37°C water. Ruse<sup>11</sup> believes that after thermo cycling of light cure composites shear bond strength (SBS) increases after 24 hours and then decreases during the next 7 days.

Some other investigators believe environment temperature, humidity and breathing speed could affect oral temperature.<sup>12</sup> Bishara has showed that bond strength could drop down about 80% after thermo cycling.<sup>13</sup> Arici has also found a significant reduction in bond strength of Modified resin glass ionomer compared to no mix composite, after thermo cycling.<sup>14</sup>

The aim of this study was to compare SBS of Ideal Maccoco and Vit L-essence light cure composites in bracket bonding after thermo cycling.

#### MATERIALS AND METHODS

This was an experimental clinical trial. The samples consisted of 100 freshly extracted upper first premolars. The exclusion criteria consisted of tooth hypoplasia, caries or fractures on the buccal surface. The teeth were restored in physiologic serum. The materials used in this research were standard edgewise stainless steel brackets of upper premolars with 0.18 slot having foil mesh base (Dentaurum, Germany), Ultradent 37% phosphoric Acid, Excite adhesive as resin bond (Vivadent), and two types of light cure composites including Ideal Maccoco (Ideal Maccoco, Iran) and Vit L-essence (Ultradent) composites.

Methods: 100 upper premolar teeth were randomly assigned into four equal groups.

In all groups the teeth were cleaned with a mixture of pumice powder and water (without oil or fluoride) by a bristle brush. Then a limited area of the buccal surface was etched by 37% phosphoric acid for 30 second, rinsed for 15 seconds and dried by a cool air source for 30 seconds. Then Excite bonding resin was applied to enamel and cured by low Intensity program with Astralis 7 light source for 40 seconds.

In the first and second group Vit-L-essence composite was applied to the bracket base, and then accurate bracket positioning in the height of contour of buccal surface and parallel to tooth

long axis was performed. The residual composite was removed from the tooth surface. Then the composite was cured by emitting light in a circular manner all around the bracket for 80 seconds.

In the third and fourth group the brackets were bonded to teeth by the same method with Ideal Maccoco composite. All the teeth were restored in 37°C deionized water following initial bonding. After 24 hours the bonded teeth in the second and fourth group were thermocycled between 5 to 55°C for 500 cycles. The duration for each single temperature was 20 seconds and the interval time between the cycles was 5-10 seconds. After completion of thermocycling all the teeth were mounted vertically in special jigs so that bracket bases were perpendicular to the horizontal plane. On the next step the brackets were debonded by a Zwick testing machine. The shear bond strength was recorded in Newton and after dividing it to the bracket base surface, (93.102 mm<sup>2</sup>) it was transformed to Mpa (Mega Pascal). The statistical parameters such as mean and SD were calculated for each group and after confirmation of normal distribution at 0.05 significance level by Kolmogorov-Smirnov test, ANOVA and Student's t-test were used to compare shear bond strength (SBS) of the groups.

#### RESULTS

Table I presents the mean values of SBS in Mpa. As it could be seen in Table I the highest SBS belongs to Vit-L-essence group before thermocycling (18.03 Mpa) while the least belongs to Ideal Maccoco after thermocycling (13.37 Mpa).

To compare the four groups ANOVA test with 95% confidence interval was used which showed no significant difference between groups ( $P>0.05$ ). To compare each pair, Student's t-test was used with 0.05 significance level. (Table I). Regarding the results of this test there was no significant difference between Vit-L-essence and Ideal Maccoco composite either before or after thermocycling. We also observed that SBS did not differ significantly before and after thermocycling in each single composite.



## DISCUSSION

The present study evaluated the effect of thermocycling on two light cure adhesive systems used for orthodontic bonding. The results of this study indicated that following thermocycling, the SBS in Vit-Lessence and Ideal Maccoco composites were  $17.48 \pm 7.26$  and  $13.37 \pm 5.1$  MPa respectively. These findings suggested that there were no statistically significant differences in mean SBS between two composites after thermocycling. These finding corroborates with the results of Dos Santos et al<sup>15</sup> who concluded that thermocycling did not influence the shear bond strength of single bond, Prime & Bond NT/NRC and One Coat bond.

In contrast Helvatjoulu et al have claimed thermal cycling significantly reduced the bond strength of single Bond and Clearfil Liner Bond which is a self etching system Hevatjoulu et al.<sup>16</sup> used bovine incisors in their study while in other studies<sup>15</sup> including ours human sound enamel, which has a different structure and characteristic, was used. In addition the composite type may have impact on the SBS in these studies. For example we used light cure composite with low intensity program, and the curing time was 80 seconds around each bracket. Ruse depicted an increase in SBS after 1 and 24 hours and then a reduction during the next 7 days.<sup>11</sup> These are not in agreement with our findings in since we found an insignificant reduction in SBS of Vit-L-essence and Ideal Maccoco composite after thermocycling. These controversial results may also be due to differences in the coefficient of thermal expansion, water absorption or solubility of different composites.

This study reveals that Vit L-essence or Ideal Maccoco composites are successfully applicable for orthodontic bonding after thermocycling.

**Table 1-** Comparison of shear bond strength (SBS) of Ideal Maccoco and Vit-L-essence composite before and after thermocycling

Composite	SBS		p-value
	BT*	AT**	
Vit-Lessence	18.0±7.49	17.4±7.26	NS
Ideal Maccoco	15.9±7.37	13.37±5.1	NS
p-value	NS		NS

\* Before thermocycling

\*\*After thermocycling

## CONCLUSION

- 1- SBS of orthodontic brackets with Vit-L essence and Ideal Maccoco light cure composite does not have a significant difference before and after thermocycling.
- 2- Thermocycling does not affect SBS in bracket bonding with each of these two composites.

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