Monomer conversion of resin adhesive under five orthodontic brackets with different curing directions.

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Objective

The aim of this study was to investigate light transmission through brackets with various filler and material compositions and the degree of cure (DC%) of orthodontic adhesive under the bracket with different curing directions. Surface microhardness was also measured to investigate the distribution of the DC%.

Bracket label	Code	Manufacturer	Composition	Structure
Inspire Ice	ICE	Ormco, Orange, CA, USA	Ceramic (alumina)	Monocrystalline
Fascination	FC	Dentaurum, Ispringen, Germany	Ceramic (alumina)	Polycrystalline
Ovation C	OV	Dentsply Sirona, USA	Ceramic (alumina)	Polycrystalline
Elegance	EL	Dentaurum, Ispringen, Germany	Glass-fiber reinforced polycarbonate with metal slot	
Mini-mat Ortomat	SS	Ortomat Herpola, Scafati, Italy	Stainless steel	

Table 1 Brackets used in this study and group codes

Material & Methods

Three ceramic, one glass-fiber reinforced polycarbonate and one stainless steel bracket were chosen. Light transmission through each bracket type was determined with a spectrometer (n=6). Then, a total of 60 brackets were divided into 5 groups according to bracket label (Table 1) and each group had two subgroups (n=6). The DC% of the adhesive (Transbond XT) was measured under the brackets when light curing was performed either from the sides or through the bracket. After curing each specimen was measured for surface microhardness of the adhesive immediately after initial 15min setting time. Data was analyzed statistically (ANOVA, Tukeys's, $p<0.05$).

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Results

Groups ICE, FC and EL attenuated approximately 65% of incoming curing light. Light attenuation was the greatest in the OV-group (70%) and the SS-group (95%) (P<0.05). Between groups ICE, FC and EL there wasn't a significant difference in light attenuation (P>0.05). ICE, FC, OV and EL showed significantly higher DC% when light curing was performed through the bracket (P<0.05) whereas in SS-group there wasn't a significant difference in the curing direction (P<0.05). The average differences in DC% with different curing directions were 12.8% for ceramic brackets, 18.1% for polycarbonate brackets and no difference were detected in stainless steel brackets. DC% values for directly cured ceramic brackets ranged from 48-52% whereas DC% under stainless steel brackets remained under 30%. Linear regression analysis revealed a significant correlation between the curing direction and the surface microhardness (Figure 1).

Conclusions

1. Ceramic and polycarbonate brackets attenuate curing light and the filler content of the bracket seems to have an effect on light attenuation
2. Light curing through the bracket is recommended in case of transparent ceramic and polycarbonate brackets. DC% is higher under ceramic brackets than under stainless steel brackets.
3. The surface microhardness of the adhesive under the bracket correlates positively with the light curing direction and the DC% of the adhesive