Adhesion of 4-META/MMA-TBB to Carious Dentin

Minimal invasive dentistry needs bonding materials which have high strength and sealability when applied not only to intact dentin but also to caries-affected dentin. The purpose of this study is to estimate the relationship between the morphology of carious dentin and micro-tensile bond strength (MTBS) of 4-META/MMA-TBB adhesive.

Results and Discussion

4-META/MMA-TBB adhesive demonstrated high bond strength not only to sound dentin but also to caries-affected dentin. MTBS to caries-infected dentin was significantly lower, although a thick hybrid layer was formed.

Conclusion

4-META/MMA-TBB adhesive demonstrated high bond strength not only to sound dentin but also to caries-affected dentin. MTBS to caries-infected dentin was significantly lower, although a thick hybrid layer was formed.

Objectives

Minimal invasive dentistry needs bonding materials which have high strength and sealability when applied not only to intact dentin but also to caries-affected dentin. The purpose of this study is to estimate the relationship between the morphology of carious dentin and micro-tensile bond strength (MTBS) of 4-META/MMA-TBB adhesive.

Materials and Methods

Eighteen extracted human molars with coronal carious lesions were selected. The flat dentin surface was polished with #180 SiC paper. Using Carie Stain (Parkell) as a guide, the dentin samples were divided into sound, caries-affected and caries-infected dentin. The dentin surfaces were treated with Green Activator (Parkell) and rinsed. The morphology of the surface was examined by SEM. 10mm of transparent acrylic resin cubes were bonded to the treated surface by 4-META/MMA-TBB adhesive (C&B Metabond;Parkell). The carious dentin can be seen through the acrylic resin because of its transparency. These specimens were then stored in 37°C water for 24 hours. For the MTBS tests, the resin-bonded teeth were sliced into 0.8mm thick samples, and the bonded surfaces were trimmed to obtain a bonded area of 1mm². After MTBS testing, specimens were observed with SEM to evaluate the interface between the bonded resins and dentin. The bond strength to the different dentin substrates was analyzed by ANOVA (p=0.05, n=10).

Results and Discussion

4-META/MMA-TBB adhesive demonstrated high bond strength not only to sound dentin but also to caries-affected dentin. MTBS to caries-infected dentin was significantly lower, although a thick hybrid layer was formed.

Fig.1 4-META/MMA-TBB adhesive and Carie Stain were used in this study.
Fig.2 Procedure of micro-tensile bond strength test.
Fig.3 SEM observation of dentin evaluated.

Fig.4 SEM images of bonding interface to caries-infected dentin which demonstrated 11.4 ± 8.2 MPa of MTBS. 50-100 µm thickness of hybrid layer demonstrated diverse constructional interfaces. Shrinkage of the caries-infected dentin destroys the HL near the interface.

Fig.5 SEM images of bonding interface to caries-affected dentin which demonstrated 23.0 ± 10.7 MPa of MTBS. Two types of hybrid layer (HL) were observed. Left image (a) shows 7-30 µm thickness of the HL which contained many voids. Right image (b) shows 10 µm thickness of the HL which has no voids.

Fig.6 SEM images of bonding interface to sound dentin which demonstrated 29.1 ± 6.1 MPa of MTBS. The thickness of hybrid layer was measured 3-5 µm.

The MTBSs were not significantly different between sound and caries-affected dentins, but MTBS to caries-infected dentin was significantly lower (p<0.05).

Fig.7 Hypothetical HL-formation model of 4-META/MMA-TBB resin to carious dentin.

Conclusions

4-META/MMA-TBB adhesive demonstrated high bond strength not only to sound dentin but also to caries-affected dentin. MTBS to caries-infected dentin was significantly lower, although a thick hybrid layer was formed.

Acknowledgments

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