Retention Comparison of Dental Sealants Using Cured Versus Uncured Adhesive

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Background

Dental sealants are widely recognized for their effectiveness in preventing occlusal cavities, particularly in pediatric patients. Systematic reviews and meta-analyses have demonstrated that dental sealants can prevent up to 80% of cavities in the first two years following application, and they maintain a prevention rate of over 50% after four years (Beauchamp et al., 2008; Simonsen, 2011). These findings emphasize the importance of optimizing sealant application techniques to enhance their longevity and effectiveness. However, the adhesive curing process may influence sealant retention, especially in pediatric care, where additional curing time could increase the likelihood of moisture contamination. Given the clinical success of dental sealants, understanding how different adhesive curing methods impact their bond strength is crucial for improving outcomes in cavity prevention.

Objective

This study aims to evaluate the retention differences of dental sealants when using uncured versus cured dental adhesive. This is particularly important in pediatric patients, where extended cure times may increase the risk of moisture contamination. By assessing the effects of curing on adhesive retention, the study seeks to identify optimal application techniques to ensure better sealant performance and reduce potential complications in clinical practice.

Methods

Sample Preparation:

- 12 de-identified molar teeth were sectioned into 24 halves with exposed, smoothed, enamel occlusal surfaces.
- Halves of the same tooth for control were divided into two groups: cured adhesive and uncured adhesive.

Surface Preparation:

- Occlusal surfaces smoothed with silicon carbide paper.
- 37% phosphoric acid etchant applied for 30 seconds, rinsed, and dried.

Adhesive Application:

- Cured adhesive group: Optibond FL (Kerr) adhesive applied and cured for 20 seconds.
- Uncured adhesive group: Optibond FL (Kerr) applied without curing.

Sealant Application:

- Clinpro sealant (3M ESPE) placed on top of cured and uncured adhesive samples and cured for 20 seconds using a VALO Grand curing light (Ultradent).

Shear Bond Strength Testing:

- Bond strength assessed using the UltraTester machine (Ultradent).

Table 1. Shear Bond Strength Results (unit MPa = megapascals)

Samples	Shear Testing	Shear Failure
1 c	9.7 MPa	Adhesive (complete)
1 un	22.9 MPa	Adhesive (partial)
2 c	8.4 MPa	Adhesive (partial)
2 un	24.2 MPa	Cohesive (partial)
3 c	12.0 MPa	Adhesive (complete)
3 un	14.7 MPa	Adhesive (partial)
4 c	17.9 MPa	Cohesive (partial)
4 un	26.5 MPa	Cohesive (partial)
5 c	15.4 MPa	Adhesive (complete)
5 un	16.4 MPa	Adhesive (complete)
6 c	20.5 MPa	Adhesive (complete)
6 un	9.6 MPa	Adhesive (complete)
7 c	7.5 MPa	Adhesive (complete)
7 un	26.0 MPa	Cohesive (partial)
8 c	25.5 MPa	Cohesive (partial
8 un	29.4 MPa	Cohesive (partial)
9 c	14.9 MPa	Adhesive (complete)
9 un	21.4 MPa	Adhesive (complete)
10 c	27.6 MPa	Adhesive (partial)
10 un	26.3 MPa	Adhesive (partial)
11 c	22.8 MPa	Cohesive (partial)
11 un	22.4 MPa	Cohesive (partial)
12 c	20.1 MPa	Cohesive (partial)
12 un	14.9 MPa	Adhesive (complete)

c= cured group,
un= uncured group,
adhesive complete= total shear failure to enamel,
adhesive partial= shear failure at level of adhesive,
cohesive partial= shear failure at sealant material

Results

Statistical analysis was conducted to evaluate the retention differences of dental sealants when using cured versus uncured adhesive. No significant difference was observed between the two groups (p = 0.053). Normality was confirmed for both groups with the Shapiro-Wilk test. A one-tailed two-sample t-test was performed assessing if retention for uncured adhesive is greater than cured adhesive. Analysis results: T-Value= -1.68, DF= 21, P-Value= 0.053

Table 2. Bond strength results [average (standard deviation)] for the sealants placed with cured and uncured adhesive (n=12). Same superscript letters indicate no statistically significant difference between groups (p>0.05).

Group	Bond strength (SD)
Cured Adhesive	16.9 (6.7)a
Uncured Adhesive	21.2 (6.0)a

Table 3. Failure modes (number / percentage of failures) for the sealants placed with cured and uncured adhesive (n=12).

Group	Failure mode (number / percentage)		
	Adhesive (complete)	Adhesive (partial)	Cohesive (partial)
Cured Adhesive	6 / 50%	3 / 25%	3 / 25%
Uncured Adhesive	4 / 33%	3 / 25%	5 / 42%

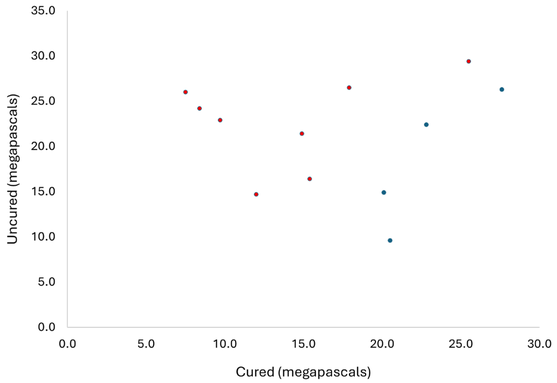

Figure 1. Cured Versus Uncured

Conclusion

This study seeks to provide insight into whether curing dental adhesive prior to sealant application improves retention or if uncured adhesive offers comparable performance, potentially reducing the risk of moisture contamination during application in pediatric settings. While the results suggest a trend toward greater retention for uncured adhesive compared to cured adhesive, the evidence is insufficient to reject the null hypothesis (p-value 0.053). Further investigation with larger sample sizes is recommended to confirm these findings and provide greater statistical power.

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