



May 8th, 2:15 PM - 5:00 PM

## **Stronger Bond, Stronger Smiles: Adhesion Techniques in Modern Dentistry**

Jana Abdulrahim  
*University of the Pacific*

Sunny Fakhri  
*University of the Pacific*

Niyousha Rafeie  
*University of the Pacific*

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# OKU Sutro Excellence Day Project Cover Sheet

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## Introduction

“Adhesion” is defined as the bond strength of a coating to substrates by American Society for Testing and Materials. Adhesives facilitate interfacial forces between surfaces to transfer load.

## Mechanism of Adhesion

### Mechanical    Adsorption    Diffusion    Electrostatic

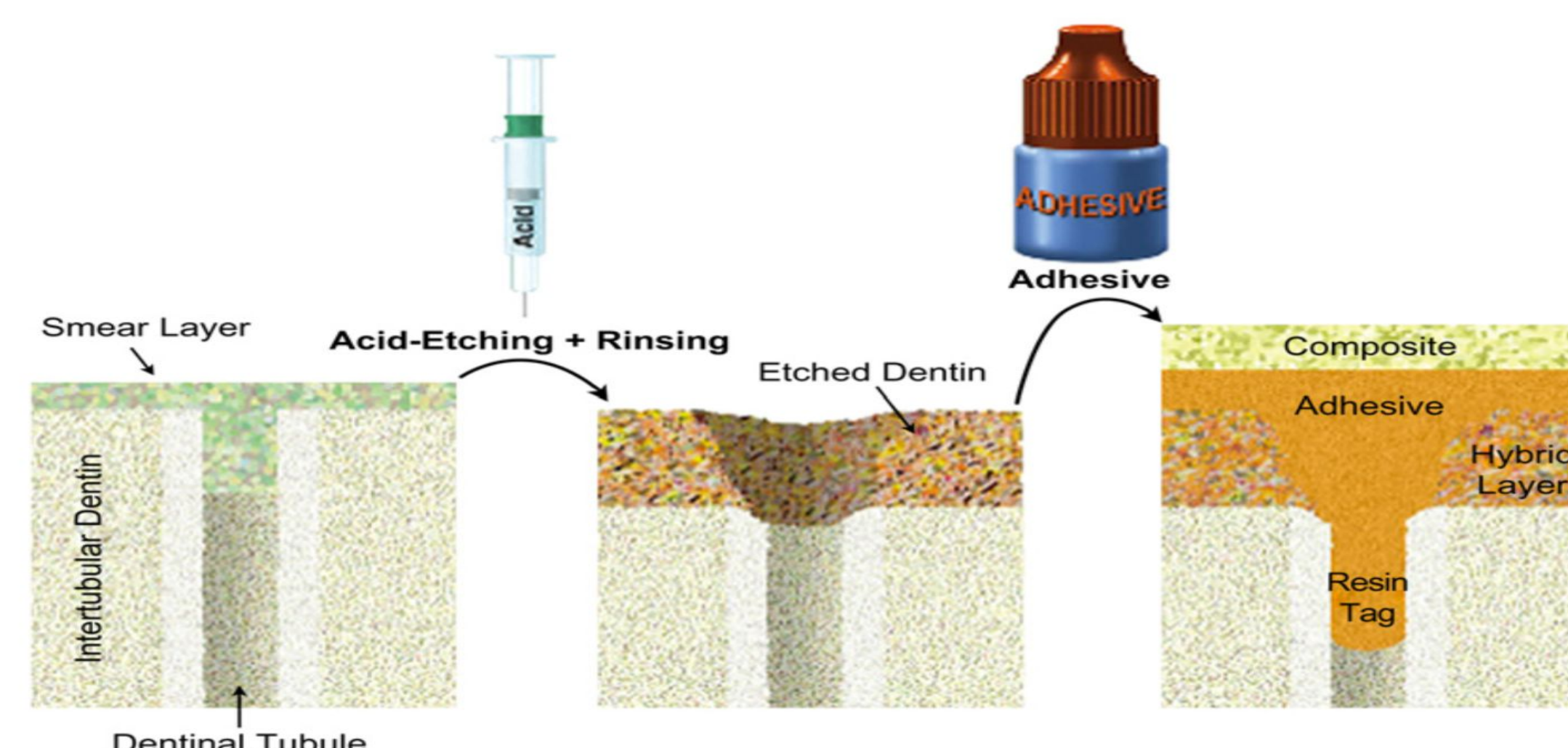


Fig. 3. Interaction of one-bottle etch-and-rinse adhesives with dentin.

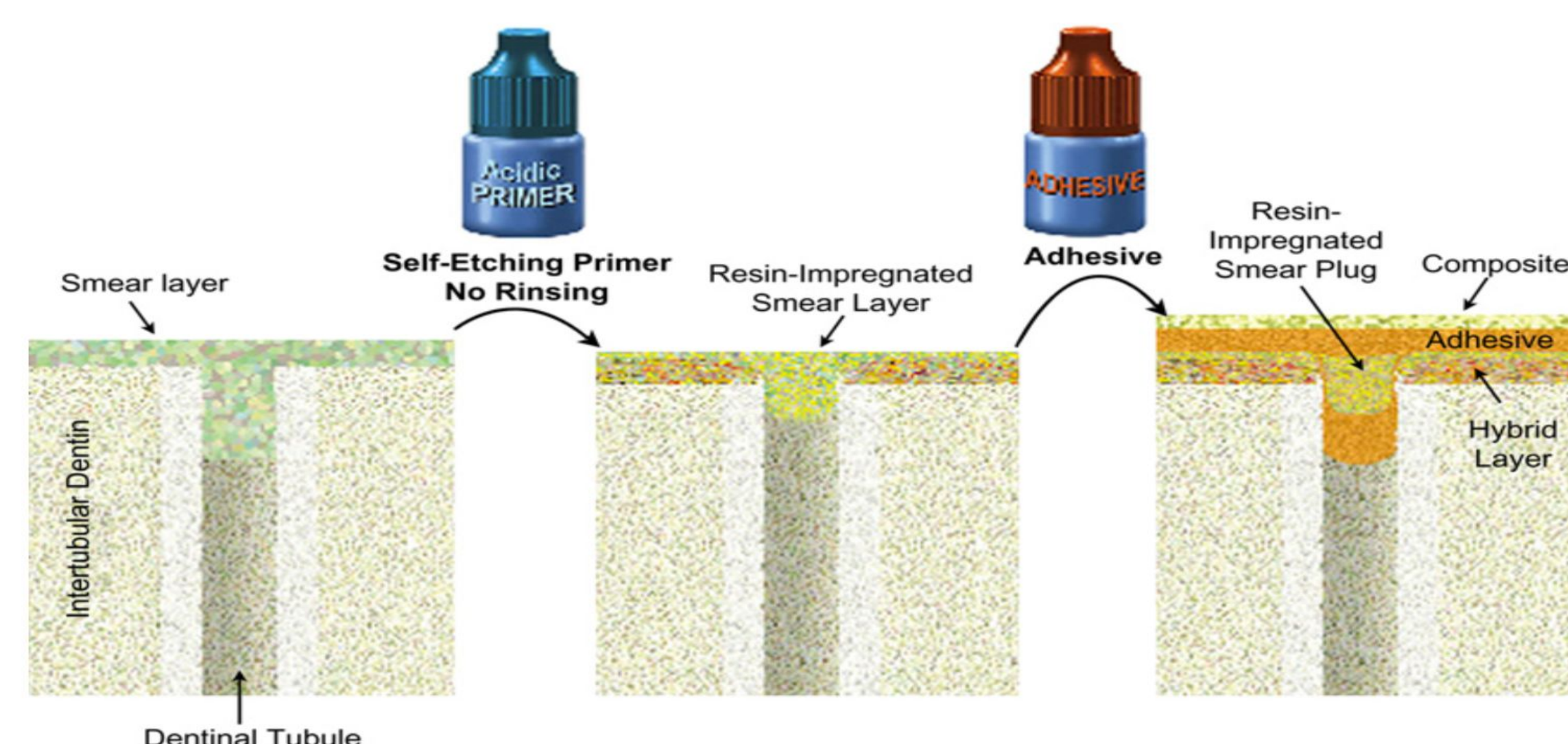


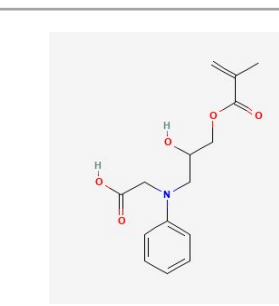
Fig. 4. Interaction of two-bottle self-etch adhesives with dentin.

## Generations of Bonding Agents

### History of Bonding/ Previously Used Bonding Agents

#### 1st Generation

1950 - 1970  
Low Bond Strength (2-3 Mpa)  
Hydrophobic Monomer  
Cervident (SS White)



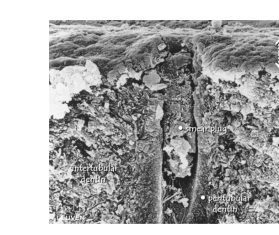
#### 2nd Generation

Late 70's and 80's  
Phosphorous ester monomers  
Low bond Strength (1-5 Mpa)  
Kuraray Clearfill Bond



#### 3rd Generation

Mildly Acidic, Hydrophilic  
Modified/ Altered Smear Layer  
Moderate Bond Strength



### Currently Used Bonding Agents

#### 4th Generation

Early 1990's  
Etch Dentin - Remove Smear Layer  
3 step - Etch + Primer + Bond  
Gold Standard - Improved Bond Strength



#### 5th Generation

Late 1990's  
Reduced number of bottles  
Etch separate, Primer + Bond Combined  
Attempted to simplify



#### 6th Generation

Combined Etch + Primer, Separate Bond  
Lower Bond Strengths  
AdSeSE, Pondering 2, Prelude

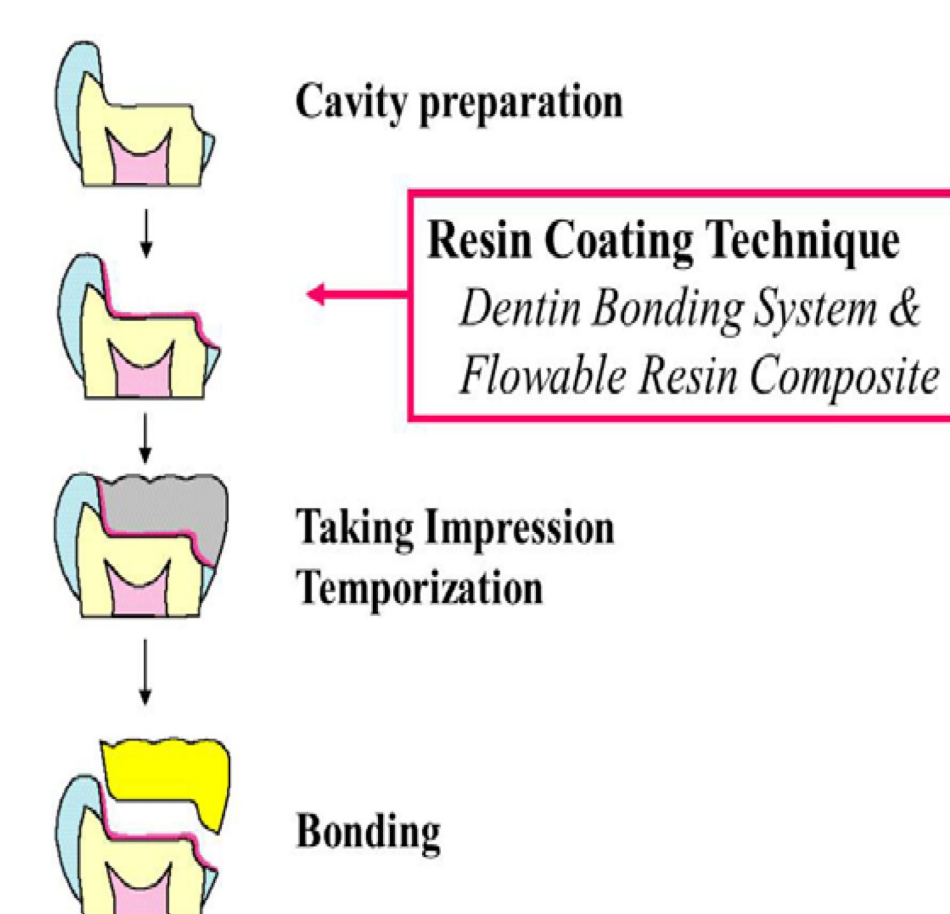


#### 7th Generation

All in one Adhesive  
Etch+ Primer + Bond in one Bottle  
No Mixing  
Scotchbond Universal



## Immediate Dentin Sealing



**Immediate Dentin Sealing (IDS)** is a method where an adhesive is applied directly to freshly cut dentin right after tooth preparation, prior to making an impression. It serves as an alternative to **Delayed Dentin Sealing (DDS)**, where hybridization occurs after the provisional phase and just before the indirect restoration luting procedure.

## Advances in Bonding and Adhesion

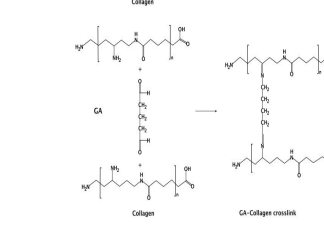
### 1. 8th Generation Bonding Agent

VACO Bond - All in one system - Higher Bond Strength - Contains nano sized fill  
- Dual Cure - Increased mechanical properties - Pacbond - G-Preimo Bond



### 2. Collagen Cross Linking Agents

Integration of collagen fibrils into the resin- dentin hybrid layer. Reinforce collagen through intermolecular crosslinking. Glutaraldehyde, Chlorhexidine, carbodiimide, Proanthocynin



### 3. Matrix metalloproteinase (MMP) Inhibitors

The breakdown of dentin collagen matrices by matrix metalloproteinases and cathepsins is considered a significant contributor to restoration failure. These agents function by inhibiting MMPs, thereby aiding in the extension of dental bond longevity. Chlorhexidine, Carbodiimide

### 4. Modification Of bonding Procedure

- One method uses **hydrophobic resin post-bonding**, air-dried for a uniform layer, resulting in a dense, resilient hybrid layer.
- Another method applies **two layers of adhesive** resin for longer resin tags, strengthening the resin-dentin bond.
- **Ethanol wet bonding (EWB)** dehydrates dentin with 50% and then 100% ethanol, enhancing resin infiltration by rapid water evaporation.

### 5. ER - YAG Laser

Laser treatment creates a textured dentin surface, exposing tubule openings without a smear layer, potentially enhancing resin bond strength. It pairs well with self-etch adhesives, though success rates remain uncertain, prompting ongoing research.

### 6. Reinforcement with Inorganic Fillers

Copper, zinc oxide, fluoride, and similar substances aid in remineralizing degraded hybrid layers. Hydroxyapatite operates on the same principle, enhancing bond strength.

### 7. Bioactive Particles

The bioactivity of these substances stems from the release of hydroxyl ions, which raise local pH, inhibiting MMP activity, promoting mineral precipitation, & exhibiting antimicrobial properties. Metallic ions not only replenish lost minerals in collagen but also shield collagen fibrils from degradation by reducing collagenase activity.

## Discussion and Conclusion

Despite significant advancements in resin-dentin bonding, ensuring consistently high bond strengths and long-term clinical success remains challenging. While current options offer simplified application and enhanced flexibility, limitations persist. Further research on moisture management, stress distribution, and biocompatibility is necessary for successful long-term adhesive restorations.

## Acknowledgment & References

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