

## **BONDING EXCELLENCE**

Welcome to Bonding Excellence. My hope in presenting this material to you is that you build on your already keen knowledge of bonding materials, principles and techniques.

Please enjoy the presentation and I urge you to be part of the conversation. As clinicians and dental professionals we can learn from each other and, together, make serving our patients an enjoyable rewarding experience.

Sam Simos, DDS

### **KEYS TO SUCCESS**



There are many different ways to approach a restorative solution. The keys to success are;

- Understanding of materials
  - Understanding of the Process
  - Understand the clinical situation you find yourself in
- A triad of events must take place in a direct or indirect restoration in order for success to be realized. The correct bonding agent must be selected. The technique of placement must be selected. You must have conversion of material.

### **CURRENT DIRECT TECHNIQUES**



- Matrix
- Adhesive
- Bulk Fill
- Composite
- Polish

### **CURRENT INDIRECT TECHNIQUES**

- Pre-Impression
- Prep
- Impression
- Temporaty
- Bond agent/cement
- Prime Substrate
- Luting material

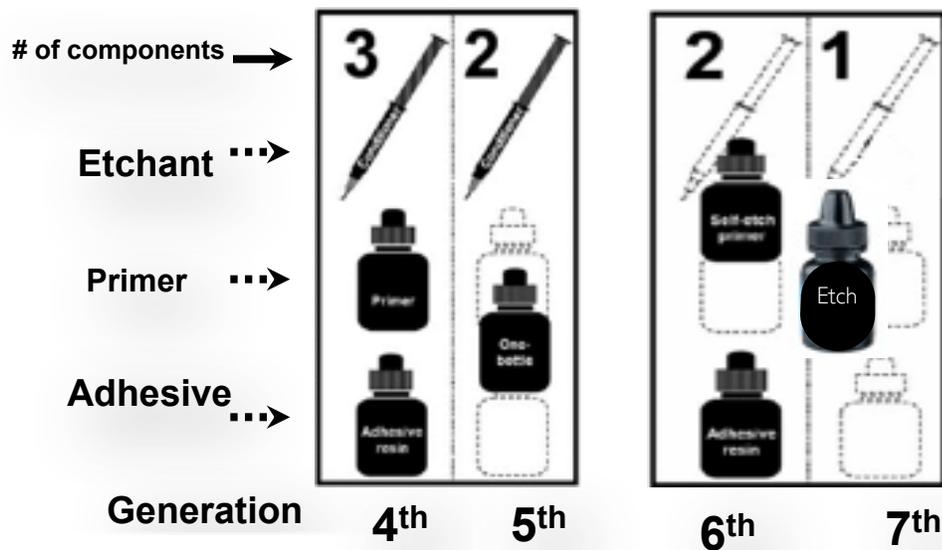
What is your current technique of direct material placement?

## EVOLUTION OF SUBSTRATES/BONDING AGENTS/TECHNIQUES

Today we have more to choose from than ever before. We now have substrates that when used properly are so lifelike they enhance the beauty from within. We can incorporate seamless margins and translucency like never before. Today is a time of awakening in the dental profession that we are all embracing as evidenced by the number of CAD zirconia and lithium disilicate crowns we are placing.

Never before have we embraced new materials as rapidly as we are embracing them today. Gone are the amalgam wars of yesterday.

The bonding agent market has exploded. From the 1960's through the 80's we saw very little change in the area of bonding agents. However from the early 1990's to late 2000's the generations of bonding agents have almost doubled; going from the 4th to 7th generation.



Dentists use these materials today, some without a clear understanding of why and in what conditions they should be used.

What material do you use?

Why?

What generation of material is your bonding agent?

Do you use it in all situations?

What are the limitations of your bonding agent?

NOTES\*\* \_\_\_\_\_

## **LIGHTS... THE MISSING LINK?**

When the blue light goes on we should not be breathing a sigh of relief. This is “go time”

The amount of light energy required to adequately cure, (convert) 2mm of composite is 16joules/cm<sup>2</sup>.  
Delivered by a 40 second exposure to a lamp emitting 400mW/cm<sup>2</sup>.

What is the power of your current curing light?

Is your curing light Halogen or LED?

The best Halogen lights

600-800 mW/cm<sup>2</sup>. This is mediocre at best. Bulbs may be old, filaments burn out. effectiveness decreases and you do not know it.

LED lights more reliable and deliver a better energy 1000-1200 mW/cm<sup>2</sup>.

TEST your lights daily with a radiometer. They should be a minimum of 1000 mW/cm<sup>2</sup>.

## **8 GUIDELINES TO ENSURE CONVERSION**

1. TEST YOUR LIGHT TO ENSURE AT LEAST 1000 mW/cm<sup>2</sup>.
2. CHANGE YOUR MAGIC NUMBER TO 20 SECONDS FOR CURING.
3. THE DEEPER THE PREP; EXTEND CURING TIME
4. REMEMBER YOU ARE ROUTINELY 8-10MM AWAY FROM THE PROXIMAL BOX FLOOR. IT'S ALL ABOUT DEPTH
5. USE TURBO TIP APPROPRIATELY. GREAT FOR CLOSE BUT NOT FOR EVERY DAY CURING.
6. BEWARE OF HEAT IF NO BASE.
7. IF YOU ARE UNSURE, ADD TIME.
8. MAKE SURE THE LIGHT HITS THE TARGET.

Action plan for my curing protocol..

Changes?

What my assistant needs to know about curing.

What kind of light do I currently use?

Light notes\*\*

## **MATRIX SYSTEMS**

The challenges of placing an anatomically correct class II restoration with proper contacts are great. We are called upon to do this often and with accuracy and consistency. We need to rely on a matrix system that can deliver results.

I recommend that the clinician have a number of different matrix systems in their arsenal. We face different challenges every day and with every placement. The toffelmyer band is widely used but hardly adequate for every situation. We have many choices today including sectional matrix systems.

What system do you use for matrix system?

Do you feel you need to upgrade your system?

What attributes do you want your matrix system to possess?

Are you using only 1 system for all of your matrix needs?

Action plan for my matrix system

NOTES\*\*\*

## **BONDING**

Bonding is either adhesive or non adhesive.

Keep it simple focus on the Interface

- Direct substrates
- Luting Cements
- Indirect Substrates

### **direct substrate steps**

1. Clean Surface
2. Bonding agent category; self or total etch
3. Surfaces; dentin, uncut/cut enamel
4. Isolation—Key to success
5. sectional matrix system
6. Bulk fill?
7. Light cure/conversion techniques

## Indirect substrate steps

Great bonding cannot compensate for poor preparation

Major clinical advantage of zirconia and lithium disilicate is that they can both be bonded or cemented—depending on the resistance of the prep and preference of the dentist.

Adhesion creates a mechanical and chemical interlocking between the substrate and tooth surface.

non-adhesive only relies on a mechanical interlocking between the substrate and tooth surface.

There are 2 different types of adhesive cements:

1. Luting cements
2. Self adhesive dual cure resin cements

## BONDING “CHEAT SHEET”

Use to evaluate whether or not to bond or cement.

		PREP TAPER				
		8°	10°	12°	16°	20°
PREP HEIGHT(mm)	4	Conventional Cement or Adhesive Cement	Conventional Cement or Adhesive Cement	Conventional Cement or Adhesive Cement	Adhesive Cement	Adhesive Cement
	3	Conventional Cement or Adhesive Cement	Conventional Cement or Adhesive Cement	Adhesive Cement	Adhesive Cement	Bond
	2	Bond	Bond	Bond	Crown Lengthening	Crown Lengthening

**Conventional Cements** - Glass Ionomer, RMGI, Zinc Phosphate  
**Adhesive Cements** - “CEM”Cements, SE primer with Hydrophobic D/C Resins  
**Bonded** - Primers/Adhesives with D/C Resin Cements

## ADHESION

- Begins with a clean disinfected surface, to create an environment that allows bonding agent to permeate collage and seal dentin.
- MMP's Matrix Metalloproteinase— enzymes activated by acid that consume the collagen/hybrid layer— devastating to the clinician.

## Limitations Are Present in All Bonding Agents

	Reduced Enamel Etch/Adhesion	Bond Incompatibilities	Post-Op Sensitivity	Excessive Film Thickness
4th			✗	✗
5th		✗	✗	
6th	✗			✗
7th	✗	✗		

- 
- Remove MMPs by washing dentin with BAC, Benzalkonium Chloride or 2% Chlorhexadine wash

## Bonding Agents

### Etch techniques

- Self-etch
- Total Etch
- Selective Etch

### Bulk Fill strategy

Bulk Fill technique allows clinician to reduce the stresses on the internal aspect of the restoration and ensure conversion of material at the deepest portion of the restoration.

## Clinical Requirements

- Adaptation
- Depth of cure
- Low shrinkage

## BIOACTIVE LINER

Apetite stimulating resin that protects the pulp. Used as a liner. Creates dentin bridges.

Extremely effective in deep preparations. Also hardens affected dentin.

## **RESIN BONDING PROTOCOL (INDIRECT RESTORATIONS)**

When talking indirect protocol please refer to the above height/axial wall chart for reference.

Remember; Zirconia and Lithium disilicate can both be bonded (adhered) to tooth structure. It can also be non-adhesively bonded, (cemented) to tooth structure.

Bonding is a better choice because it is more durable, however it is not always possible because of saliva, blood, or light.

Non-retentive (veneer prep, short crown preps) require Total Etch

Bonding also requires the substrate, Zirconia or Lithium disilicate, to be Primed.

### **Priming**

Priming Turns the substrate from a hydrophilic environment to a hydrophobic resin loving environment. Without priming the crown, bonding will fail in both the short and long term



Zirconia crown that was not primed. Note that the luting cement bonded to the tooth side but not the crown side.

### **Bonding to fully retentive crowns— (4-10° Taper/3-4mm wall height/strong core**

Using a self adhesive cement, the tooth side of the protocol does not need to have anything done except cleaning with chlorhexadine or BAC. The crown side however needs to be primed. Traditionally, for Lithium disilicates, a Silane primer would be used. For Zirconia a product like Z-prime plus, (Bisco) would be used. However with the advent of universal adhesives (6th and 7th) generation, we can use these instead. Please check mnfg. insert to make sure your adhesive can be used as a primer. After the primer has been placed and blown dry. the crown can be inserted. There is no need to re apply after try in.

### **Bonding to short tapered no-retentive crowns— (Over 12° Taper/less than 4mm wall height/strong core**

Bonding these types of restorations was not possible in the past. In fact, cementing these types of restorations would always lead to premature failure. Today we can predictably restore this type of situation.

## **LAB COMMUNICATION**

Failure of bonded restoratives can also happen when we do not communicate with our laboratory. We assume they are sending the restoration to us ready to place in the mouth. However they do not know what your protocol is. How can they. The following is a guideline to use when establishing a protocol for bonding restoratives.

How does your lab send you your Lithium Disilicate crowns? You will need to have a conversation with them to find out or let them know how you would like to receive them. Then set up a protocol in your office for bonding.

### **Protocol for placing Zirconia;**

Bonding of Zirconia is only done if the crown preparation is non-retentive; that is, shorter than 4 mm and over 12° taper. Otherwise, when the crown preparation is retentive the Zirconia crown should be cemented with conventional cement. (few restorations are retentive).

Conventional cementation of a Zirconia crown requires priming of the zirconia crown with Z-prime +. NOTE\* Priming of Zirconia substrate is not necessary if you are using Ceramere cement. This is the only cement that does not require priming of zirconia or LD substrate.

### **ZIRCONIA Bonding protocol;**

1. When the crown is received from the lab, prime the zirconia with Z-Prime +.
2. Try in the crown in the patient's mouth and confirm seat of crown on tooth.
3. After try in, clean the crown with alcohol pledget. There is no need to re prime the zirconia.
4. **An optional step at this point** is to apply a bonding agent inside the zirconia crown. If you do this, I would suggest a thinner bonding agent like a 7th gen, (Prime & Bond Elect). the technique is to apply the BA, blow out and

light cure. Set the crown aside at this time and get the tooth ready for bonding. If you choose not to do this step, you can proceed to the next step without applying the bonding agent in the zirconia crown, as long as you have primed the zirconia substrate.

5. Remember, bonding to tooth structure begins with clean collagen. Now is the time to isolate the prep, and clean the collagen with either BAC infused Phosphoric acid etch or 2% Chlorhexidine solution like Consepsis. NOTE\*\* If you do not use BAC infused phosphoric acid at this step you may need to use a phosphoric acid in the next step depending upon the BA you use.

6. After cleaning the preparation, apply the bonding agent on the tooth. I suggest a 7th generation BA, as it is thin self etching and effective.

7. Light cure the BA on the tooth side and then apply the Luting cement into the crown. This is where you have to think about the luting cement. What kind of luting cement are you using? Dual cure, self cure, light cure, or Self adhesive. Use the luting cement accordingly.

Remember; KEEP THE MAIN THING THE MAIN THING!. substrate type/priming/collagen clean/bonding agent/luting cement

### **Lithium Disilicate bonding protocol**

1. When the crown is received from the lab, prime the LD crown with a **Silane primer**.

2. Try in the crown in the patient's mouth and confirm seat of crown on tooth.

3. After try in, clean the crown with alcohol pledget or Phosphoric acid etch. There is no need to re prime the LD crown.

4. **An optional step at this point** is to apply a bonding agent inside the LD crown. If you do this, I would suggest a thinner bonding agent like a 7th gen, (Prime & Bond Elect). the technique is to apply the BA, blow out and light cure. Set the crown aside at this time and get the tooth ready for bonding. If you choose not to do this step, you can proceed to the next step without applying the bonding agent in the LD crown.

5. Remember, bonding to tooth structure begins with clean collagen. Now is the time to isolate the prep, and clean the collagen with either BAC infused Phosphoric acid etch or 2% Chlorhexidine solution like Consepsis. NOTE\*\* If you

do not use BAC infused phosphoric acid at this step you may need to use a phosphoric acid in the next step depending upon the BA you use.

6. After cleaning the preparation, apply the bonding agent on the tooth. I suggest a 7th generation BA, as it is thin, self etching and effective.

7. Light cure the BA on the tooth side and then apply the Luting cement into the crown. This is where you have to think about the luting cement you choose to use. What kind of luting cement are you using? Dual cure, self cure, light cure, or Self adhesive. Use the luting cement accordingly.

Remember; KEEP THE MAIN THING THE MAIN THING!. substrate type/priming of substrate/collagen clean/bonding agent/luting cement

The other point of confusion seemed to be when you repair the porcelain in office or have to re-bond a de-bonded LD or Zirconia crown.

### **Re-bond or repair protocol for Zirconia**

1. Clean inside of crown or fractured piece of porcelain to repair by mild sandblasting (2-3 bars) with <50 microns Aluminum Oxide. Rinse thoroughly.

2. Confirm seat of crown in the mouth.

3. Apply Z-prime+ inside of crown or on fractured Zirconia.

4. Apply bonding agent on inside of crown or on fractured Zirconia. If you are repairing the zirconia the next step would be to place composite on the fractured area and shape as necessary. If you are re-bonding, go to step 5.

5. Remember, bonding to tooth structure begins with clean collagen. Now is the time to isolate the prep, and clean the collagen with either BAC infused Phosphoric acid etch or 2% Chlorhexidine solution like Consepsis. NOTE\*\* If you do not use BAC infused phosphoric acid at this step you may need to use a phosphoric acid in the next step depending upon the BA you use.

6. After cleaning the preparation, apply the bonding agent on the tooth. I suggest a 7th generation BA, as it is thin self etching and effective.

7. Light cure the BA on the tooth side and then apply the Luting cement into the crown. This is where you have to think about the luting cement. What kind

of luting cement are you using? Dual cure, self cure, light cure, or Self adhesive. Use the luting cement accordingly.

**Re-bond or repair protocol for LD**

1. Clean inside of crown of any debris then mildly sandblast the inside of the LD crown or fractured piece of porcelain with 9.5% Hydrofluoric Acid for 90 seconds. Rinse thoroughly.
2. Confirm seat of crown in the mouth.
3. Apply Silane primer on inside of crown or on fractured LD.
4. Apply bonding agent on inside of crown or on fractured LD. If you are repairing the LD the next step would be to place composite on the fractured area and shape as necessary. If you are re-bonding, go to step 5.
5. Remember, bonding to tooth structure begins with clean collagen. Now is the time to isolate the prep, and clean the collagen with either BAC infused Phosphoric acid etch or 2% Chlorhexidine solution like Consepsis. NOTE\*\* If you do not use BAC infused phosphoric acid at this step you may need to use a phosphoric acid in the next step depending upon the BA you use.
6. After cleaning the preparation, apply the bonding agent on the tooth. I suggest a 7th generation BA, as it is thin self etching and effective.
7. Light cure the BA on the tooth side and then apply the Luting cement into the crown. This is where you have to think about the luting cement. What kind of luting cement are you using? Dual cure, self cure, light cure, or Self adhesive. Use the luting cement accordingly.

For questions or comments please contact  
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Dr. Simos

Thank you for your attention today. I hope you enjoyed the presentation.