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|-------------|---------------------------------------|---|--------|
| subject: | THE WORLD OF DENTAL NETWORKING | | |
| | CHICAGO DENTAL SOCIETY | | |
| | 144TH MIDWINTER MEETING | | |
| | FEBRUARY 26 - MARCH 1, 2009 |  | group: |
| | McCORMICK PLACE, CHICAGO | | |
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COURSE C02B
COMPOSITE MIRRORING
 BRIAN LESAGE, DDS
 THURSDAY, FEBRUARY 26, 2009

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Composite Mirroring

Success of Bonding:

| <u>Material</u> | or | <u>Technique</u> |
|-----------------|----|-------------------------|
| Composite | | Adhesion |
| Tints | | Color |
| Opaquers | | Layering |
| Adhesive | | Customization |
| Armamentarium | | Finishing and Polishing |

MATERIAL:

A. COMPOSITE:

Ideal Composite Material

1. Mirror natural tooth structure in color and translucency
2. Strength to withstand function in high stress bearing areas for the long term
3. Seamless or undetectable margin from restoration to tooth for the long term
4. Achieve the appropriate luster and polish and maintain it for the long term

“No one material has been able to meet both the functional needs of a posterior Class I or II restoration and the superior esthetics required for anterior restorations”

Mitra, S., Wu, D., and Holmes, B: “An Application of Nanotechnology in Advanced Dental Material,” JADA 134: Oct, 2003)



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Definition:

A multiphase substance formed from a combination of materials that differ in composition or form, remain bonded together and retain their identities and properties.

(Lee, S.M., Preface, Dictionary of Composite Materials Technology, Lancaster, PA; Technic Publishing Company, 1989)

Indications:

1. Direct Abfraction
2. Direct Erosion
3. Direct Restoration of Decay
4. Direct Anterior Tooth Reconstruction
5. Cement :
 - a. All ceramic restoration
 - b. Orthodontic brackets
 - c. Invisalign®
6. Base/ Liner/ Block Out
7. Post & Core
8. Mock-up
9. Splinting
10. Provisionalization
11. Gingival Stabilization

HYBRIDS vs. MICROFILLS vs. NANOFILLER

Adhesively bonded composite restorations have the advantage of conserving sound tooth structure with the potential for tooth reinforcement, while at the same time providing cosmetically acceptable restorations.

Most conservative, less invasive, predictable restoration of teeth to normal form and function with tooth color material.



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HYBRIDS

Composition

1. 1.0 micron average glass particle size & .04 silica in resin

Advantages:

1. Strength - less likely to chip in high strength area
2. Refractory properties - opacity similar to enamel and dentin
 - A. Exhibit superior strength
 - B. Improve abrasion resistance
 - C. Reduce Polymerization Shrinkage
 - D. Lower coefficient of thermal expansion
 - E. Reduced water sorption

Disadvantages:

1. Polish ability - not long term.

Indications:

1. Layer the desired shade deep within the restoration to mimic dentin and enamel morphology.
2. Provide strength in any functional area.

Manufacturers:

1. 3D- Direct (Vident)
2. Aelite All-Purpose Body (Bisco)
3. Esthet-X® & TPH-3® Micro Matrix (Dentsply/ Caulk)
4. Filtek Z250 & Z100 MP and Filtek LS/ Silorane (3M/ESPE)
5. Herculite XRV & Point 4 (Kerr)
6. Renamel Hybrid (Cosmedent)
7. Charisma & Venus (Heraeus Kulzer)
8. Tetric Ceram and 4 Seasons (Ivoclar-Vivadent)
9. Matrixx Posterior (Discus)
10. Virtuoso & TrueVitality (Den-Mat)
11. Vit-l-escence (Ultradent)



MICROFILLS

Composition:

1. 1.0 micron average glass particles in resin

Advantages:

1. Polish ability – high shine for the long term
2. Wear resistance better than microhybrids
3. Refractory properties - translucency similar to enamel

Disadvantages:

1. Lacks strength for some functional areas can be too translucent
 - A. High water sorption
 - B. Non-radiopacity
 - C. Tendency to have lower compressive strengths
 - D. Fracture resistance
 - E. Stiffness
 - F. Fatigue
 - G. Strength and hardness

Indications:

1. Replace enamel in color and translucency
2. Polish ability
3. Wear resistance and surface texture.

Manufacturers:

1. Amelogen Microfill (Ultradent)
2. Renamel Microfill (Cosmedent)
3. Durafill VS (Heraeus Kulzer)
4. Heliomolar (Ivoclar-Vivadent)
5. Sculpt-It Microfill (Jeneric Pentron)
6. Matrixx Anterior Microfill (Discus)



NANOFILLER

1. Nanotechnology or molecular technology or molecular nanotechnology of functional materials and structures in the ranges of 0.1 to 100 nanometers.
2. Essence of small-billionth of a meter
3. Hydrogen Atom –0.1-0.2nm
4. Bacterium 1,000nm or 1 micrometer (um)
5. Nanoclusters are about the same size as a MicroHybrid, so why are they better?
6. The nanoclusters can break off individual primary particles rather than plucking out the larger secondary particles.
7. The resulting worn surface has smaller defects and better gloss retention, less surface roughness.

Composition:

1. 20 nm primary particle size consisting of zirconia-silica nanoclusters and silica nanoparticles (0.01 glass particles in resin)

Advantages:

1. Strength -less likely to chip in high strength areas
2. Refractory properties - opacity similar to enamel and dentin
3. Polishability - high shine for the long term
4. Wear resistance better then microhybrids and microfills
5. Refractory properties - translucency similar to enamel

Disadvantages

1. No in vivo long-term studies.

Indications:

1. All anterior and posterior restorative applications?

Manufacturers:

1. Filtek Supreme-Plus Universal Restorative (3M/ESPE)
2. Premise (Kerr)
3. Aelite Aesthetic Enamel (Bisco)
4. Gradia Direct X (GC Ameerica)
5. Ceram*x (Dentsply/Caulk)



II. TINTS

Indications:

1. Match natural tooth structure in polychronicity and maverick colors
2. Help mask out tooth/restorative interface
3. Lower the value

Manufacturers:

1. Tescera Color (Bisco)
2. Creative Color (Cosmedent)
3. Cerinate Shade Modification System II (Dent Mat)
4. Tetric color (Ivoclar-Vivadent)
5. Kolor +Plus (Kerr)

III. OPAQUERS

Indications:

1. Raise the value
2. Block dark tooth color in thin layer
3. Help mask out tooth/ restorative interface
4. Block excessive translucency in CL III & IV

Manufacturers:

1. Creative Color (Cosmedent)
2. Tescera Color (Bisco)
3. Cerinate Shade Modification System II (Dent Mat)
4. Kolor +Plus (Kerr)

IV. ADHESIVES

Science and Chemistry

Category

1. Total Etch
2. Self Etch



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Total Etch

1. Three-Step System
2. One Bottle System

Self Etch

1. Two Bottle System
2. All-in-One System

TOTAL ETCH**THREE-STEP SYSTEM****Advantages:**

1. Excellent Bonding Strengths - most consistent
2. Versatility- use with self-cure and dual cure composites

Disadvantages:

1. More steps associated with more clinical time
2. More steps can lead to more errors

Van Meerbeek, B. et al., "Three-year clinical effectiveness of four total-etch dentinal adhesive systems in cervical lesions," Quintessence Int 27(11):775-784, 1996.

Peutzfeldt, A. et al., "A survey of the use of dentin-bonding systems in Denmark," Dent Mater 17(3):211-216, 2001.

Manufacturers:

1. All-Bond 3 (Bisco)
2. Bond-it! (Jeneric/Pentron)
3. Optibond/FL (Kerr)
4. Permaquick (Ultradent)
5. Probond (Dentsply/Caulk)
6. Scotchbond Multi-Purpose/Plus (3M/ESPE)
7. Syntac (Ivoclar Vivadent)



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ONE BOTTLE SYSTEM

Advantages:

1. Good to excellent bond strength
2. Fewer steps associated with time savings

Disadvantages:

1. Post-operative sensitivity
2. ?? Use with self-cure and dual-cure composites

Swift El, et al., "Clinical Evaluation of two one-bottle dentin adhesives at three years." J Am Dent Assoc 132(8): 1117-1123, 2001

Frankenberger, R, et al., "Techniques sensitivity of dentin bonding: Effect of applications mistakes on bond strength and marginal adaptation," Oper Dent 25(4): 324-330, 2000.

Clinical Research Associations: "Core buildup and adhesive incompatibility." CRA Newsletter 24(6): 1-2, 2000.

Clinical Research Associations: "Self-Etch Primer(SEP) Adhesive Update." CRA 27(1112): 1-6, 2003.

Manufacturers:

1. Excite (Ivoclar Vivadent)
2. Gluma Comfort Bond & Desensitizer (Heraeus Kulzer)
3. One-Step (Bisco)
4. Optibond Solo Plus (Kerr)
5. Prime & Bond NT (Dentsply/Caulk)
6. PQ 1 (Ultradent)
7. Single Bond (3M/ESPE)
8. Tenure Quick w/FL (Den-Mat)

SELF ETCH -

1. Two-step System
2. All-in-one System



TWO-STEP SYSTEM

Advantages

1. Good to excellent bond strength
2. Minimal to no post-operative sensitivity
3. Versatility: use with self-cure and dual-cure composites
4. Fewer steps associates with time savings

Disadvantages:

1. Ability to bond to sclerotic dentin and enamel
2. Bond decrease over time

Miyazaki. M. et al., "Durability of enamel bond strength of simplified bonding system," Oper Dent 25(2): 75-80, 2000.

Clinical Research Associations: "Enamel-dentin adhesives, self-etching primers" (SEP). CRA Newsletter 24(11): 1-3, 2000.

Manufacturers

1. A.R.T. Bond (Coltene/Whaledent)
2. Clearfil SE Bond & Clearfil Protect Bond (Kuraray)
3. Clearfil Liner Bond 2V (Kuraray)



ALL-IN-ONE SYSTEM

Advantages:

1. Fewer steps associated: time savings
2. Quite low post-operative sensitivity

Disadvantages:

1. Poor to excellent bond strength
2. ??? Use with self-cure and dual-cure composites
3. Durability of bond to enamel and dentin

Denehy, G.E. et al., "Clinical performance of a self-etching primer/adhesive in posterior composites," (abstract 340) J Dent Res 79: 186, 2000.

Wilder, A.D. et al., "Six month clinical evaluation of an all-in-one dentin adhesive," (abstract 234) J Dent Res 80: 65, 2001.

Manufacturers:

1. Adper Prompt-L-Pop (3M/ESPE)
2. All-Bond SE & AB SE Liner (Bisco) Use with LC, DC, & SC composite materials
3. Touch & Bond (Parkell)
4. One Up Bond F (J Morita)
5. ClearFil S3 Bond (Kuraray)
6. G-Bond (GC America)-- Recomend for LC restoratives and dual-cure cements
7. Xeno IV (Dentsply/Caulk)

| Category | System | Steps | Etch | Prime | Bond/Adhesive |
|---------------|------------|-------|------|-------|---------------|
| TOTAL ETCH | Three Step | 3 | XXXX | XXXX | XXXX |
| | One Bottle | 2 | XXXX | XXXX | |
| SELF ETCH | Two Step | 2 | XXXX | | XXXX |
| | All-in One | 1 | XXXX | | |



V. ARMAMENTARIUM

1. Composite Instruments
2. Composite Burs
3. Rubber Dam
4. Matrices
5. Finishing
6. High Polish
7. Fine Brushes

1. **Composite Instruments:**

Application, sculpting, shaping, interproximal carving, retracting

- A. Titanium
- B. Gold
- C. Stainless Steel

Ideal:

- A. Non-stick
- B. Non-corrosive
- C. Autoclavable
- D. Hold shape

2. **Composite Burs**

Preparation: Carbides, diamonds

Finishing: Diamonds, Carbides(8, 16, 32 fluted)

Manufacturers:

- A. BluWhite Trimming and Finishing Carbides or Diamonds (Kerr)
- B. ET Finishing Bur and Diamonds (Brasseler)
- C. Finishing Burs (Ultradent)
- D. Finishing Burs (Dentsply)
- E. Prisma Finishing Burs (Dentsply/Caulk)
- F. Two Striper MFS (Premier)
- G. UCLA Aesthetic Continuum Anterior Kit (Brasseler)

3. **Rubber Dam**

Shear bond strength were found to be higher for specimen that had been isolated with the rubber dam.

Quint Int. 26(2):95-110.



4. **Matrices**

- A. Mylar strips
- B. Palodent Matrix and Biotene Rings
- C. Garrison Matrix
- D. Wedges

5. **Finishing**

- A. Burs
- B. Discs
- C. Rubber Cups and Points

Manufacturers

- A. Astropol (Ivoclar-Vivadent)
- B. D Fine Diamond Polishing Point for Hybrids (Clinician's Choice)
- C. Diacomp (Brasseler)
- D. Diagloss (Axis)
- E. Enhance Finishing and Polishing System (Dentsply/Caulk)
- F. FlexPoints, FlexiCups, FlexWheels (Cosmedent)
- G. Jiffy Polishing Cups, Points, Disc (Ultradent)

Interproximal Strips

- A. FlexiStrips (Cosmedent)
- B. Soft-Flex Polishing Strips (3M/ESPE)
- C. EpiteX (GC)
- D. VisionFlex Strips (Brasseler)

6. **High Polish**

- A. Polishing Discs
- B. Polishing Wheels
- C. Polishing Pas

Manufacturers

- A. Enamelize (Cosmedent)
- B. TruLuster (Braessler)
- C. HighGloss (Dentsply/Caulk)



7. **Fine Brushes**

- A. Contour, sculpt
- B. Apply opaquers and tints

Manufacturers

- A. Kerr
- B. Cosmedent
- C. Art Store

TECHNIQUES

Procedural aspects (i.e., techniques) of adhesive restoration placement can have greater influence on restoration longevity and pulp vitality than the choice of restorative material used.

Hewlett E., Cox C., “Clinical Considerations in Adhesive Restorative Dentistry- Influence of Adjunctive Procedures.” JourCDA June 2003, Vol 31, No 6.

1. **ADHESION**

Basic Principles

- A. Rubber Dam
- B. Etch
- C. Primer
- D. Adhesive/Bond/Resin

A. **Rubber Dam Purpose**

- (1) Prevention of contamination by saliva or blood during critical steps or restoration placement is key to achieving an optimum outcome.
- (2) Use of a rubber dam is still widely regarded as the most effective method of moisture control, in addition to improving visibility and access, protecting patients from aspirating or swallowing small objects, and reducing microbial transmission from patients to dental personnel.



B. Etch Purpose

- (1) Etchant: conditioner, cleanser
- (2) Mild Acids, low concentration of strong acids, chelating agents
- (3) Examples: Maleic, Nitric, Phosphoric and Ethylenediaminetetraacetic (EDTA) Acid
- (4) Purpose: alter or remove the smear layer

Etch

“Conditioner may open the orifices of dentinal tubules partially, demineralized peri- and intertubular surface dentin, and expose collagen fibrils.” (Erickson RL. Surface interactions of dentin adhesive material. Oper Dent 5(suppl): 81-94, 11992),

“Conditioners by removing the smear layer expose and make porous and permeable the intertubular and peritubular surface dentin.” (Charlton DG. Dentin Bonding: Past and Present. Gen Dentistry Nov/Dec 1996: 498-505).

C. Primer Purpose

Primer: Adhesive promoter, enhancer

Bi-functional monomer in a solvent such as water, acetone, alcohol/ethanol

Consists of:

- (1) Hydrophobic end group: extends away from the dentin surface, bonds to the unfilled resin or resin composite
- (2) Hydrophilic end group: bonds to moist dentin
- (3) Examples: HEMA, NMSA PMDM, 4-META

Primer Purpose: Link the dentin to the resin

Primers promote infiltration of unfilled resin into the demineralized dentin surface and exposed collagen fibrils. Improve the wettability of conditioned dentin and contact between the dentin and resin.

Charlton DG., “Dentin Bonding: Past and present.” Gen Dentistry Nov./Dec 1996: 498-505.



D. Adhesive/ Bond/ Resin

- (1) Bond: adhesive, bonding, resin or sealing resin
- (2) Unfilled Bis-GMA or UDTA (urethane dimethacrylate)
- (3) Frequently have HEMA (Bifunctional monomer)

Infiltrate the demineralized dentin and exposed collagen fibrils, and then polymerizing. Form a *resin-reinforced hybrid zone*.

Primers and adhesive resin are applied to infiltrate demineralized dentin and exposed collagen fibrils. Upon polymerization, the monomers form a hybrid layer (resin-reinforced) of resin, collagen and hydroxyapatite crystals.

Nakabayashi N., Watanabe A., Gendusa, NT., "Dentin Adhesion of "Modified" 4-META/Mma-TTB resin function of HEMA." Dent Mater 1992; 8: 259-264.

Sensitivity Issues:

- (1) Over etch
- (2) Over dry prior to prime
- (3) Under dry after prime
- (4) Agitate primer
- (5) Light curing unit
- (6) Incremental fill
- (7) C-factor
- (8) Rubber dam isolation



Chroma: Saturation of Color Dark, rich red or light red

Shade A: A1, A2, A3, A3.5, A4

Shade B: B1, B2, B3, B4

Value: Brightness (grayness)

- A. Increase brightness – increase value — decrease greyness
- B. Decrease value — Decrease brightness -- Increase in greyness
- C. Manufacturer’s Value B1, A1, B2, D2, A2
- D. O’Brien study with Spectrophotometer A1, B1, B2, A2, D2

Translucency: Grayness

Opalescence: Enamel ability to take natural light and reflect blue

Fluorescence: Dentin ability to convert invisible light to visible light

3-D Master Shade Guide

Choose Value first

Then choose Chroma (low, medium, high)

Then Hue (Red on right: Yellow on left)

EasyShade Spectrophotometer

Confirm the visual shade taken with “extreme accuracy”.

Shade Progression Guideline:

- A. Central Incisors- brightest
- B. Lateral Incisors- slightly lower in value
- C. Canines- higher Chroma



3. LAYERING

CI III Restorations

A Preparation

- (1) Remove old restorations and decay
- (2) StarBurst bevel of 2+mm except on gingival margin if on root
- (3) Enamel periphery

B Layering:

- (1) One shade- MicroHybrid
- (2) Two+ shades- MicroHybrid E or D overlaid with Incisal/ Translucency OR MicroFill

C Material Selection

- (1) Small, conservative, lingual entry
MicroHybrid resin alone, for ease of placement and finish, and strength
- (2) Large, facial preparation
Hybrid resin internal for ease of placement and finishing, opacity and strength followed by 1mm superficial layer of MicroFill resin for smoothness, wear resistance, and reduced superficial stain

CRA Newsletter. Volt 23, Issue 4, April 1999.

CL V RESTORATIONS

A Preparation

- (1) Remove old restorations and decay
- (2) StarBurst bevel of 2+mm except on gingival margin if on root
- (3) Enamel periphery

B Layering:

- (1) One Shade- MicroHybrid
- (2) Two+ shades- MicroHybrid E or D overlaid with Incisal/Translucency OR MicroFill



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C Material Selection

- (1) MicroHybrid: for ease of placement, finishing, and moderately good wear resistance.
- (2) MicroFill: material flexibility, polishability, wear resistance.
- (3) MicroHybrid resin internal and MicroFill resin for outer 1mm Hybrid resin internal for ease of placement and finishing, opacity and strength followed by 1mm superficial layer of MicroFill resin for smoothness, wear resistance and reduced superficial stain.
- (4) Hybrid Ionomer (RRGI) with no outer resin layer for optimal fluoride, unless esthetic need are high then cover with 1mm layer of microfill, compomer can be used, but fluoride release is less over time.

CL IV RESTORATIONS

Diastema Closure, Full Veneer

A Preparation

- (1) No prep to full 1+mm reduction
- (2) Remove old restorations and decay
- (3) StarBurst bevel of 2+mm except on gingival margin if on root
- (4) Enamel periphery

B Layering:

- (1) One shade: MicroHybrid or MicroFill
- (2) Two+ shades: MicroHybrid E or D overlaid with Incisal/Translucency OR MicroFill

C Purpose: to create

- (1) Dentinal Lobes
- (2) Incisal Translucency
- (3) Incisal Halo



D Undetectable Margins:

- (1) Place a proper bevel
- (2) Etch past the end of the bevel
- (3) Roll the outer layer with clean gloved hands for sculpt ability and to prevent inclusions or voids
- (4) “Super” cure the composite and wait 5+ minutes before finishing
- (5) Finish margin back to between the etch and the end of bevel
- (6) Rotate finishing armamentarium from restoration to tooth
- (7) Do NOT use rubber on the margins
- (8) High polish appropriate for the natural dentition

4. CUSTOMIZATION

A Maverick colors

B Check lines: 5 techniques

- (1) Paint and thin
- (2) Scar and paint
- (3) Matrix
- (4) Vertical wall for depth
- (5) Anneal material over stain

C Incisal Effect

- (1) Contour: Young, 20s, 30s, 40s, 50s, 60s
- (2) Incisal Halo



5. FINISHING and POLISHING

A **Good Polish: UCLA Bur Kit**

B **Very Good Polish: Disc system and mandrels**

C **Excellent Polish: Polishing and buffing wheels, cups, points**

D **Void Repair**

E **Appropriate Polish:**

(1) Run through Diamond/ Carbides

(2) Polishing wheels and Disc—NO rubber on margins

When finishing sequence with the 30-blade carbide bur is complete, the clinician can, as an alternative to polishing discs, simply acid-etch the restoration again, add a single or double-brush stroke of the solution, and polymerize accordingly. This helps to protect the newly delivered margin from tooth brushing, chromatogenic bacteria, and similar attacks that generally result in staining over long periods.

Goldstein R., PPAD: Aug 2003.



CHICAGO DENTAL SOCIETY MIDWINTER MEETING COURSE EVALUATION

SPEAKER: _____ DATE: _____

SUBJECT: _____ NUMBER OF ATTENDEES: _____

PLEASE RATE YOUR SPEAKER AS TO:

| | Excellent | Good | Fair | Poor | N/A |
|---|-----------|------|------|------|-----|
| SUBJECT SELECTED | 4 | 3 | 2 | 1 | 0 |
| TIMELINESS OF SUBJECT | 4 | 3 | 2 | 1 | 0 |
| COMPREHENSIVENESS | 4 | 3 | 2 | 1 | 0 |
| MEETING YOUR EXPECTATIONS | 4 | 3 | 2 | 1 | 0 |
| CONTENT LEVEL | 4 | 3 | 2 | 1 | 0 |
| DELIVERY | 4 | 3 | 2 | 1 | 0 |
| VOICE QUALITY | 4 | 3 | 2 | 1 | 0 |
| HOLDING YOUR INTEREST | 4 | 3 | 2 | 1 | 0 |
| APPROPRIATE AUDIOVISUALS | 4 | 3 | 2 | 1 | 0 |
| EFFECTIVE AUDIOVISUALS | 4 | 3 | 2 | 1 | 0 |
| OVERALL EVALUATION OF SPEAKERS | 4 | 3 | 2 | 1 | 0 |
| OVERALL EVALUATION OF THE PROGRAM | 4 | 3 | 2 | 1 | 0 |

SHOULD THIS SPEAKER BE INVITED FOR FUTURE MEETINGS?

YES NO

WHAT TOPICS INTEREST YOU FOR THE FUTURE? _____

COMMENTS (use reverse if you need additional space): _____

NAME (REQUESTED BUT NOT REQUIRED—PLEASE PRINT): _____

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