Are you still diagnosing with this?

50% accurate

How do you diagnose decay?

Approximately 25% demineralization must occur to see a cavity on a conventional radiograph. Equates to 40-60% demineralization on the tooth surface. Radiographs miss 70-80% of occlusal cavities.

Digital radiographs provide the ability to manipulate image size & appearance.

67% accuracy

How do you diagnose decay?

Thru intraoral photographic interpretation?

SOPRUCARE
**PARADIGM SHIFT**

- One can place a number of restorations or fillings and yet not treat the underlying disease.
- The bacteria remain in the plaque on the teeth, capable of creating new areas of tooth decay.
- Patients value a shift from a surgical approach to disease management and prevention.

**THE CANARY SYSTEM**

Crystal Structure Diagnostics

- The Canary System detects cracks & cavities not visible on X-rays.
  - Around & beneath intact margins of fillings & crowns
  - Under sealants (including opaque sealants)
  - On proximal surfaces
  - On smooth surfaces, pits & grooves
  - Around orthodontic brackets

- Measures tooth structure breakdown, allows for early treatment.
  - Restores conservatively
  - Remineralizes back to health
  - Deal with confidence

Research claims validated by 60+ papers
15+ case reports & 2 FDA CTR 21 clinical trials

**THE SCIENCE BEHIND THE CANARY SYSTEM**

- Pulses (2 Hz) of laser light hit the tooth surface.
- Tooth glows (Luminescence, LUM) and releases heat (Photo-Thermal Radiometry, PTR).
- Defective tooth crystal structure affects the retained heat and luminescence signatures.

**Energy Conversion Technology**

- Temperature increase < 1°C not harmful

- Detected signals reflect the tooth's condition.
- Detects 50 micron lesion up to 5 mm below the surface.
THE CANARY ALGORITHM IS THE CORE FUNCTION THAT TAKES PTR-LUM AMPLITUDES AND PHASES AND CONVERTS TO A NUMERICAL SCALE:

- The strength of the converted heat signal (PTR Amplitude)
- Time delay of the converted heat to reach the surface (PTR Phase)
- The strength of the emitted luminescence (LUM Amplitude)
- Time delay of the emitted luminescence (LUM Phase)

**THE CANARY NUMBER**

**THE CANARY NUMBER MAPPING**

- Camera Image with Grid
- Nine Section Grid: Allows easy identification of the scanning area. Canary Number for each section is stored in computer memory. Squares are colour-coded for status of decay.

**SENSITIVITY & SPECIFICITY STUDY: UNIVERSITY OF TEXAS OCTOBER 2012**

**CANARY IS SUPERIOR TO X-RAYS FOR PROXIMAL CARIES DETECTION**


**Objective:**
To compare the accuracy of The Canary System, ICDAS-II and bitewing radiographs in detecting proximal caries in vitro.

**Methods:**
- **ICDAS-II (Direct Visual Examination):** Blinded examiners ranked 100 proximal surfaces using ICDAS-II by direct visual examination of the surfaces.
- **Manikin mouth models:** The teeth were then set in manikin mouth models, creating contacting proximal surfaces that very closely resemble in vivo situation.
- **Histological validation:** All surfaces were examined by polarizing light microscopy to confirm the presence and depth of the caries lesions.

**Conclusion:**
- BW radiographs could only identify 26.7% of the lesions which questions its ability to be the gold standard.
- The Canary System is the only method examined with both high sensitivity and high specificity.
- The Canary System is more sensitive than bitewing radiographs in detecting interproximal caries.

<table>
<thead>
<tr>
<th>Caries Detection Method</th>
<th>Canary System</th>
<th>DIAGNODent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>100%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Specificity</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Spearman Correlation</td>
<td>.84</td>
<td>.21</td>
</tr>
</tbody>
</table>

**CANARY PATIENT REPORT**

- Customized patient report on dental practice letterhead
- Available on Canary Cloud
- Clear simple indication of problem areas
- Patients can track their progress
- Engages patients in their oral health care
- Medical model for treatment of tooth decay
Fluorescent Technologies

WHAT FLUORESCES IN FLUORESCENT-BASED TECHNOLOGIES?

- BACTERIAL PORPHYRINS (BACTERIAL BREAKDOWN PRODUCT),
- STAIN,
- TARTAR,
- FOOD DEBRIS

ALL FLUORESCES UNDER THE WAVELENGTHS USED IN MOST CARIES DETECTION DEVICES, WHETHER OR NOT CARIES IS PRESENT.


PAIN MANDIBULAR RIGHT POSTERIOR QUADRANT

No pathology on x-ray. Canary Scan revealed pathology on mesial & distal marginal ridge and caries around the lingual margin of the amalgam.

REMOVAL OF AMALGAM CONFIRMS CARIES

Caries around the lingual margin.

Crack on mesial and distal marginal ridges with caries. Caries around the lingual margin.

INTERPROXIMAL CARIES DETECTION

Bitewing radiograph did not detect caries. Caries located on buccal aspect of the contact area.

DETECTION OF CARIES BENEATH SEALANTS

- Canary Numbers >20 when scanning sealants (3M™ ESPE™ Clinpro™ Sealant) placed over pit & fissure caries.
- The caries detection ability of the Canary System was not affected by sealant & was more accurate than DIAGNOdent.

Sensitivities and specificities for pit & fissure caries detection after sealant placement.

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canary</td>
<td>83%</td>
</tr>
<tr>
<td>DIAGNOdent</td>
<td>79%</td>
</tr>
</tbody>
</table>

The Life Cycle of Tooth Decay

- Remineralization
- Remineralization Therapies
- The Canary System Scan
- X-Ray, Fluor, & Band

Detection of caries beneath sealants.
UTILIZATION

- APPLY TWICE A DAY, AM & PM
- AFTER BRUSHING AND FLOSSING
- PEA SIZE AMOUNT ON FINGER AND RUB IT ON THE TEETH
  - YOU CAN FLOSS IT BETWEEN THEM AS WELL
- RUB THE MATERIAL AROUND ALL THE TEETH WITH TONGUE
- LEAVE ON THE TEETH FOR APPROXIMATELY 3 MINUTES
- SPIT OUT EXCESS BUT DO NOT RINSE OR DRINK FOR 30 MINUTES.

Minimally Invasive Cosmetic Treatment

- ETCH FOR 1-2 MINUTES
- APPLY MPASTE PLUS FOR 10 MINUTES
- PATIENT APPLIES AT HOME 2X/DAY

Enamelon Now with Stannous Fluoride

Optimized with ACP® Technology

PREMIER'S NEW ENAMELON®

- STABILIZED SnF₂ FORMULA
- ACP TECHNOLOGY
- SINGLE TUBE - ANHYDROUS
- SUBSTANTIETY INGREDIENTS
  - ULTRAMULSION®
  - GANTREZ
  - REFRESHING TASTE

OLD ENAMELON

- NAF FORMULA
- ACP TECHNOLOGY
- DUAL TUBE - AQUEOUS
- REFRESHING TASTE

Premier Dental Presents:

Stabilized SnF₂ (970 ppm) Preventive Treatment Gel designed to deliver ACP

1. Helps Prevent Caries
2. Helps Prevent Gingivitis
3. Treats Sensitivity
1. Independent Testing Data: Therametric Technologies, Inc. 2014
2. Negative Control (Water) recorded an uptake of 8 ppm

1. Independent Testing Data: Therametric Technologies, Inc. 2014
2. Negative Control (Water) recorded an increase in solubility (−5.45%)

**ENAMELON® PREVENTIVE TREATMENT GEL**

- SAFE FOR ALL AGE GROUPS
- SAFE ALTERNATIVE TO 5000 PPM FLORIDE PASTES
- OPTION FOR YOUNG CHILDREN WITHOUT INCREASED RISK OF FLUOROSIS
- NONABRASIVE (RDA 8)
- SALIVA-STIMULATING
- NO SLS
- NO DYES, GLUTEN, OR DAIRY-BASED INGREDIENTS
- REFRESHING CLEAN MINT FLAVOR

**ppm Fluoride Dose**

<table>
<thead>
<tr>
<th>Population</th>
<th>IOM Fluoride Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants 0-6 months old</td>
<td>0.7 mg/day</td>
</tr>
<tr>
<td>Infants 7-12 months old</td>
<td>0.9 mg/day</td>
</tr>
<tr>
<td>Children 1-3 years old</td>
<td>1.3 mg/day</td>
</tr>
<tr>
<td>Children 4-8 years old</td>
<td>2.2 mg/day</td>
</tr>
<tr>
<td>Children &gt; 8 years old</td>
<td>10 mg/day</td>
</tr>
</tbody>
</table>

**ENAMELON® TOOTHPASTE**

- 1150 PPM SNF, TOOTHPASTE DELIVERING ACP
- LOW ABRASIVE (RDA 39)
- SALIVA-STIMULATING
- NO SLS
- NO GLUTEN, DYES OR DAIRY-BASED INGREDIENTS
- REFRESHING CLEAN MINT FLAVOR
Restorations
CHEMISTRY, INDICATIONS & PLACEMENT TECHNIQUE.

Restoration variations for durable class I & II restorations
- Composite (& bonding agent)
- Flowable (& bonding agent) or Glass Ionomer or Activa

Adhesion variations for durable class I & II restorations
- Composite (& bonding agent)
- Activa or Glass Ionomer

Dentin Replacement with Composite Cap
- Dentin substitute
  - Glass Ionomers
  - Flowable Resins
  - What bonding agent?
- Enamel Replacement
  - Modern NanoHybrid Composite
  - CR April 2014 NanoHybrid offers best results

SUBSTRATE
- BEST LONG TERM BONDS TO PHOSPHORIC ETCHED ENAMEL.
- SUPERFICIAL DENTIN CAN HAVE HIGH BOND STRENGTHS BUT HAS MMP ACTIVITY AND WATER ABSORPTION WHICH WILL DISRUPT BONDS WITH TIME EVEN THOUGH IT OFFERS HIGHER BOND STRENGTHS THAN DEEP DENTIN.
- LARGER THICKNESSES OF COMPOSITE STRESS THE BOND TO TOOTH STRUCTURE.
Technique

X-RAY OF BOND 5MM OF FLOWABLE

POSTERIOR COMPOSITES

- KURARAY – CLEARFIL MAJESTY ES2
- GC AMERICA – GRADIA
  - KALORE
- IVOCLEAR – 4 SEASONS, TETRIC EVO CERAM, EMPRESS DIRECT
- HERAEUS – VENUS DIAMOND
- SHOFU – BEAUTIFUL II
- DENTSPLY – TPH SPECTRA, ESTHET.X HD
- SEPTODENT – N ‘DURANCE
- PULPDENT – ACTIVA
- ULTRADENT – VITALESCENCE, AMELOGEN PLUS
- TOKUYAMA – ESTELITE SIGMA QUICK & OMEGA
- SDI – AURA
- PENTRON – SIMILIE
- VOCO – GRANDIO SO
- DENMAT/PHILIPS/DISCUS – NUANCE
- KERR – PREMISE, HERCULITE ULTRA, SONICFIL
• **DENTIN, ENAMEL, MULTIPURPOSE & BULKFILL**

• **NANO HYBRID**
  - Handles extremely well
  - Good body to compress but not too thick
  - Sculptable but not sticky
  - Enamel microhybrid
  - Softer
  - Waxier
ADVANCES IN COMPOSITE RESTORATIONS:

Flowables are being used to ensure wetting to the adhesive service and creating a layer with less polymerization stress because of a lower modulus of elasticity. (But higher shrinkage?)

ADA reports flowable resins are used by 82% of dentists as bases or liners.

BULK FILL COMPOSITES

• DENTIN & ENAMEL REPLACEMENT
  • REQUIRES ONE LAYER
  • BONDING AGENT USED?
  • LONG TERM RESEARCH?

DENTIN BULK FILL COMPOSITES

• BULK FILL COMPOSITES 4GM MAX TYPICALLY
• MORE TRANSLUCENT
• TYPICAL SHRINKAGE IS APPROX. 3.1-3.5%
• SHRINKAGE STRESS IS 1.6*-3.13MPA
• VENUS BULK FILL COMPOSITE & FLOWABLE (KULZER)
• SUREFIL SDR FLOW (DENTSPLY)
• TETRIC EVOCERAM BULK FILL (IVOCLAR)
• XTRA BASE (VOCO)
• FILTEK BULK FILL (3M/ESPE)
• BEAUTIFIL BULK FLOW (SHOFU)
**BULK FILL COMPOSITES**

- **BULK FILL COMPOSITES** 4mm MAX TYPICALLY
- **MORE TRANSLUCENT**
- **TYPICAL SHRINKAGE IS APPROX. 1.5 - 1.8%**
- **SONICFILL KERR (5MM)**
- **VENUS BULK FILL (KULZER)**
- **QUIXX (DENTSPLY)**
- **TETRIC EVOCERAM BULK FILL (IVOCLAR)**
- **XTRA FILL (VOCO)**
- **FILTEK SUPREME PLUS (3M/ESPE)**

**SELECT HV ETCH**

**SELECT HV ETCH** is a high viscosity 35% phosphoric acid etchant, available with or without Benzalkonium Chloride (BAC): an antimicrobial and Matrix Metalloprotease (MMP) Inhibitor.

**NEW BULK FILL SELF CURE MATERIAL**

- **NO BONDING AGENT NECESSARY**
- **NO LAYERING BULK FILL**
- **NO POLYMERIZATION STRESS**
- **BIOACTIVE**
- **BIOAVAILABLE**
- **NO SENSITIVITY**
ACTIVA incorporates reactive ionomer glass, a patented ionic resin, and a patented, shock-absorbing synthetic rubber molecule to deliver excellent esthetics with high compressive and flexural strengths that mimic the physical and chemical properties of natural teeth.

ACTIVA materials are tougher, more durable, more impact resistant, have much higher flexural strength, and are more cohesive, elastic and esthetic than traditional glass ionomers and RMGIs, without sacrificing their bioactive properties.

These properties position ACTIVA as a bioactive dentin and tooth replacement material with the strength and esthetics of restorative composites.
Direct Composite Restorations Placement Techniques

Bonding to Enamel/Dentin
Self-Etching

Drawbacks:
- Need to selective etch enamel
- MMP activity from acidic monomers pH < 2
- Bond strength
- Technique
- Sensitivity

Handpiece Lubricants


Higher bond strengths when using tungsten carbide burs with SE adhesives

Long-term failure occurs at gingival margins and adhesive interfaces.

Adhesion process - Self-Etching

Use Carbide Burs
Large layers inhibit acidic monomers
Duration of exposure & acidity
TRADITIONALLY, NUMEROUS INCREMENTS HAVE TO BE PLACED TO DIMINISH POLYMERIZATION SHRINKAGE AS WELL AS STRESS ON TOOTH STRUCTURE.

What substrate are we treating?

- Composite Preparation

Class I or II

3x Tubule Density Equals Higher Fluid & Increased Difficulty for Bonding 30% Decrease in Bond Strengths with most bonding systems.

Problem

VARYING TOOTH SUBSTRATES

Enamel & Variable Dentin Bonding
RESIN–DENTIN BONDS ARE NOT AS DURABLE AS WAS PREVIOUSLY THOUGHT. MICROTENSILE BOND STRENGTHS OFTEN FALL 30% TO 40% IN 6 TO 12 MONTHS.

Factors that compromise bond durability in restorative dentistry

Hydrophilic dentin bonding (1956 -)

“Dentin adhesive systems are going in the wrong direction.”

Factors that compromise bond durability in restorative dentistry

Hydrophilic dentin bonding (1956 -)

We challenged that current dentin adhesive designs that incorporate increasing concentrations of hydrophilic monomers are going in the wrong direction.

Hydrophilic dentin bonding (1956 -)

“Microtensile bond strengths of dentin to composite often fall 30% to 40% in 6 to 12 months.”

Factors that compromise bond durability in restorative dentistry

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Factors that compromise bond durability in restorative dentistry

Hydrophilic dentin bonding (1956 -)
What is the best adhesive?

Can you get good results?

INSTRON

- ULTRA TESTER (ULTRADENT)
- ULTRA JIG (ULTADENT)
SHEAR BOND TEST RESULTS - 2012
Average Shear Bond Strength to Dentin: 24.2 MPa

Maximum/Minimum Shear Bond Strength per Bonding Material

Remember……

…….FAST IS TYPICALLY NOT THE BEST, UNLESS WE ARE DISCUSSING CAR RACING.

CONCLUSIONS

“ADHESIVE TECHNOLOGY HAS UNDERGONE GREAT PROGRESS IN THE LAST DECADE. IN LIGHT OF THE MAJOR DRAWBACKS ATTRIBUTED TO ALL-IN ONE ADHESIVES, CONVENTIONAL 3-STEP ETCH & RINSE ADHESIVES & (MILD) 2-STEP SELF-ETCH ADHESIVES ARE STILL THE BENCHMARKS FOR DENTAL ADHESION IN ROUTINE CLINICAL PRACTICE”.

NEW “UNIVERSAL” SYSTEMS

• SIMPLE & EASY TO USE
• DIRECT & INDIRECT TECHNIQUES
• USE AS TOTAL, SELECTIVE OR SELF ETCH
• LOW SENSITIVITY
“Adhesive dentistry could be expressed as a simple relationship between bonds and stress. If the bonds can withstand the stress, the restorative technique will be successful.”

Unterbrink and Liebenberg (1999)

In light of the major drawbacks attributed to all-in one adhesives, conventional 3-step etch & rinse adhesives and (mild) 2-step self-etch adhesives are still the benchmarks for dental adhesion in routine clinical practice. When bonding to enamel, an etch & rinse approach is definitely preferred, indicating that simple micro-mechanical interaction appears sufficient to achieve a durable bond to enamel. When bonding to dentin, a mild 2-step self-etch approach is superior, as it involves (like with glass-ionomers) additional ionic bonding with residual HAp. This additional primary chemical bonding definitely contributes to bond durability. Altogether, when bonding to both enamel and dentin, selective etching of enamel followed by the application of the 2-step self-etch adhesive to both enamel and dentin currently appears the best choice to effectively and durably bond to tooth tissue.


Flowables
- Access, viscosity, small areas
- Deep, narrow preps
- Lots of enamel
Flowables
- Voco (Grandio SO HF, Xtra Base)
- Kerr (Revolution, Premise, Vertise)
- Ivoclar (Tetric Flow)
- Heraeus (Venus Diamond Flow, Bulk Fill)
- SDI (Wave MV, HV)
- Shofu (Beautiful Flow Plus-Zero & Low Flow)
- G.C. America (G-aenial Universal Flo)
- Dentsply (SureFil SDR, EsthetX Flow)
- Kuraray (Clearfil Majesty ES Flow)
- Tokuyama (Estelite Flow Quick)
- 3M (Filtek Supreme Flow Plus)

GRANDIO SO FLOW (& HEAVY FLOW)
- HIGH COMPRESSIVE & FLEXURAL STRENGTHS
- GOOD MODULUS OF ELASTICITY
- LOW SHRINKAGE

Beautiful Flow Plus - SHOFU
- UNIVERSAL RESTORATIVE MATERIAL
- AMAZING VISCOSITIES
- HIGH STRENGTH, WEAR RESISTANCE & POLISH/GLOSS
- SURFACE PRE-REACTIONGLASS (S-PGR) IONOMER TECHNOLOGY PROVEN BY INDEPENDENT CLINICAL TRIALS AS PUBLISHED IN JADA*

G.C. America (G-aenial Universal Flo)
- Operates like a low-flow flowable, and performs like a restorative
- New polymer chemistry formulated with DuPont
- Innovative delivery system
- Easy access, handling and placement
- Recommended for Class I, II, III, IV and V Restorations
- Higher strength than the leading flowables and conventional composites
- Higher wear resistance than the leading flowables and conventional composites
- Higher gloss retention than many conventional composites
- Contains 15 shades in three opacities
- bis-GMA free

“C-FACTOR” DEFINITION
CONFIGURATION FACTOR:

THE RATIO OF BONDED TO UN-BONDED (FREE) SURFACES.

FEILZER, DEGEE, DAVIDSON (1987):
UNIVERSITY OF AMSTERDAM, ACTA

Lowest Stress
Low Stress
Medium Stress
High Stress
Highest Stress
"C-FACTOR" DEFINITION

Excellent Flow & Handling

FLOWABLE COMPOSITE SHRINKAGE

Composite bulk placed into the cavity

DRAWBACKS OF ANY COMPOSITE RESIN

- MATERIAL PLACEMENT TECHNIQUES
- VARIABLE SUBSTRATE
- POLYMERIZATION STRESS & SHRINKAGE
- WATER ABSORPTION
- HYDROPHOBIC BONDING AGENTS
- DECREASED ADHESIVE BOND STRENGTH OVER TIME
- MMPS AND CATHEPSINS
- MICROLEAKAGE
DECREASED BOND STRENGTHS DUE TO

- Substrate
- Preparation Technique
- Bur Selection
- Hand Piece Oils
- Bonding Agent
- Curing Device and Position
- Material Selection
- Layering Technique

Why Glass Ionomers?

- They produce good marginal integrity.
- They shrink only one ninth the amount of composite material.
- They are fluoride-rechargeable.
- There are no free monomers in the material.
- The cavity preparation can be bulk-filled, making the materials easy to place.
- They exhibit excellent biocompatibility.

Why Glass Ionomers?

- Eliminate sensitivity
- Lowest shrinkage & coefficient of thermal expansion
- Self-bonding
- High strength
- Improved aesthetics
- Hydrophilic
- Continual fluoride release
- Long lasting sealant and adhesion
- Acid resistant layer

Large Defects (occlusal)

Recurrent decay

pulpal proximity
LARGE Sized Lesions (>2MM)

- Mostly Dentin
- Dentin has more moisture and less substance
- Open and closed defects
- Complications & risks are higher
- Porous, wet, dentin available
- Interproximal concerns
- Increased occlusal loading
- Remaining tooth structure

PHYSICAL PROPERTIES OF NATURAL DENTIN

Healthy Enamel to Dentin Tensile Strength ~ 50 Mpa & DEJ

Bond Strength Ranges:
40-60 Mpa (with "Gold Standard" Bonding Systems)

PROPERTIES OF DEEP DENTIN

Deep Dentin

- Bond Strength Ranges: 10MPa – 30MPa
- 3x Tubule Density Equals Higher Fluid & Increased Difficulty for Bonding
- %30 Decrease in Bond Strengths with most bonding systems.

BOND STRENGTHS RELATED TO TYPE OF DENTITION

- DEJ
- Superficial (Sound) Dentin
- Beveled Enamel
- Deep Dentin
- Affected Carious Dentin
- Infected Carious Dentin

Irie m, ozaki k, watts dc, 2004, marginal gap formation of light activated restorative materials, affects of immediate-setting shrinkage and bond strength. Dent Mat 18, 2002; 203-210

Vanmeerbeek,, B, Demunck, et al
Lambrechts P.
Micotenisile Bond Strengths of an Etch and Rinse and adhesive to enamel and dentin 2003, 657-660

Sattansuk, the bond of resin to different dentin characteristics

Note Caries on floor of 2nd Molar
Seals & Protects the Pulp:
• For Direct & Indirect Pulp Capping
• Light-curable, Radiopaque Liner based on improved MTA-technology.
• Significant Calcium Release:
  • Stimulates Hydroxy Apatite & Dentin Bridge Formation.

Indications for Use

DIRECT PULP CAPPING
• CARIOUS EXPOSURES
• MECHANICAL EXPOSURES
• EXPOSURES DUE TO TRAMA

INDIRECT PULP CAPPING
• UNDER AMALGAM RESTORATIONS
• UNDER CLASS I & II COMPOSITE RESTORATIONS
• UNDER OTHER BASE MATERIALS
• UNDER CEMENTS
  • AS AN ALTERNATIVE TO:
    • CALCIUM HYDROXIDE
    • GLASS IONOMER/ RMGI
    • CAVITY VARNISH SEALER

Unique Benefits and Clinical Significance

Calcium Release affects:
1. Mechanical Sealing of the pulp
2. Hydroxy apatite formation
3. Secondary bridge formation

Alkaline pH promotes Healing and Apatite formation & reduces risk of cavities

Moisture tolerant - improves the ability to form a durable seal

THERACAL LC (BISCO)
RIVA SC HV (SDI) GLASS IONOMER
“Adhesive dentistry could be expressed as a simple relationship between bonds and stress. If the bonds can withstand the stress, the restorative technique will be successful.”

Unterbrink and Liebenberg (1999)

“A Simple Pain-Free Adhesive Restorative System by Minimal Reduction & Total-Etching (1993)

Takao Fusayma DDS,
Tokyo Medical & Dental University

How are you restoring these different preparations?

GLASS IONOMER SANDWICH

- Class I, II, III & V posterior restorations
- Open & Closed Sandwich techniques
- Composite replacement
- Amalgam replacement
- High caries risk patients
- Pediatric patients
- Geriatric patients
- Special needs patients
- Long term resistance to microleakage

Internal (Polymerization) Stresses of Composites

Deep Preparations

- Bonding Agent & Flowable composite
- Conventional Glass Ionomer or RMGI & Composite
  - Fluoride Release
  - High compressive strength
  - Hydrophilic
  - Insoluble
  - True chemical adhesion
  - Minimizes microleakage
  - No sensitivity
  - Acid Base Resistant Zone
  - Decreased gap formation & C Factor
  - Coefficient of thermal expansion is similar to dentin

Microleakage testing in vitro using three different bases under composites

Abstract:
8th Generation Bonding Agent?

- RIVA BOND LC (SDI)

SRT™ incorporates bioactive proprietary ionglass™ technology with advanced glass ionomer resin technology ensuring minimal stress at all bonding interfaces.

RIVA BOND LC (SDI)

**INDICATIONS**

- Universal adhesive for direct restorations
- Bonding composite resin to self-cured/light-cured glass ionomer cement in the sandwich technique
- Bonding between layers of composite resin in large restorations to reduce polymerization shrinkage stress
- Sealing hypersensitive cervical areas
- Adhesive lining under amalgam fillings

**Adhesion process – Riva Bond LC**

Etchant/Dentin Conditioner

- Smear layer

Glass Ionomer

Dentin

Dentin tubule

Dentin fluid

Odontoblast

**RIVA BOND LC**

- Stress relieving bonding system
- Most things shrink, RIVA LC expands slightly, seals cavity and reduces polymerization stress caused by composite shrinkage
- Covalent bond (chemically) to tooth.
- No post op sensitivity
- Superior bond strength
- Seals tooth (22 micron film thickness)
- Acid/base resistant zone
- Cohesive failure
- BPA free
- RIVA BOND LC has a slight positive expansion unequivocally sealing the cavity preventing both stress and microleakage.
Dry with oil free air, but do not desiccate.

Tap on counter twice and then activate by depressing on counter.

Once activated place it immediately into mixer.
Apply a thin layer on the preparation with care to avoid pooling.
GLASS IONOMER MATERIALS

- DENTSPLY-CHEMFIL ROCK RESTORATIVE
- SDI-RIVA LC, LIGHT CURE HV, RIVA SC, SELF CURE HV
- G.C. AMERICA-FUJI II LC, EQUIA FIL (FUJI IX)
- VOCO-IONOLUX, IONOFIL MOLAR AC
- 3MESPE-KETAC NANO, PHOTAC FIL QUICK, VITREMER, KETAC MOLAR QUICK, KETAC FIL PLUS

OPEN & CLOSED SANDWICH TECHNIQUES

Glass Ionomer Bulk Fill

EQUIA FIL

EQUIA™ Fil is a complete system that is an ideal solution for posterior restorations:

- Class I, II, III and V posterior restorations
- Composite replacement
- Amalgam replacement
- High caries risk patients
- Pediatric patients
- Geriatric patients
- Special needs patients
- Buildups
- Long term provisionals
WHAT DOES EQUIA COAT DO?
FILL POROSITIES TO INCREASE PHYSICAL PROPERTIES OF THE RESTORATION AND OFFERS A MUCH SMOOTHER SURFACE...

Some voids are observed
A smooth surface is obtained

EQUIA Fil
Polished by using silicon carbide paper (#600)

EQUIA Fil
After coating

RIVA SELF CURE HV (SDI)
CONVENTIONAL GLASS IONOMER

SDI
COMPRESSIVE STRENGTHS

- GC EQUIAFIL COMPRESSIVE STRENGTH 255MPA
- RIVA SC COMPRESSIVE STRENGTH 271MPA
- CHEMFIL ROCK COMPRESSIVE 200MPA
- VOCO IONOLLIX HAD HIGHER COMPRESSIVE STRENGTH THAN EQUIAFIL OR CHEMFIL ROCK
- SUREFIL SDR COMPRESSIVE STRENGTH 220MPA
- DENTIN 280MPA-297MPA
- ENAMEL 384MPA
- GRANDIO SO HF HAS COMPRESSIVE 417MPA
- FUJI II LC 170MPA (RMGI) COMPRESSIVE STRENGTH

MINIMALLY INVASIVE PREPARATIONS

CHEMFIL ROCK VS CONVENTIONAL G.I.
GLASS Ionomer Interface

- Open Sandwich with glass ionomer & nanohybrid composite

Resin to Dentin Hybrid Zone

In vivo occlusal GI margin
**DIRECT RESTORATION LAYERING REVIEW**

- Bonding Agent + Composite Layering
  - Enamel is present around cavosurface margins
  - In superficial dentin
  - Moisture control is achievable
  - No pulpal proximity
- Glass Ionomer + Bonding Agent + Composite
  - Lack of enamel, deep prep or if preparation is on dentin and cementum interproximally
  - Close proximity to gingiva
  - Subgingival
  - Moisture control poses an issue
  - Close pulpal proximity
- Glass Ionomer Bulk Fill
  - Enamel or dentin present
  - Close proximity to gingiva
  - Subgingival
  - Moisture control poses an issue
  - Close pulpal proximity
  - Less than half the occlusal isthmus width

**ABFRACTION LESIONS**

- Sometimes it presents as single teeth due to exclusive interferences or as a pivot, fulcrum or “teeter totter” tooth.
- Other times there are more in a quadrant and there is severe wear to the occlusion.
- Other times it may be on the facials of anterior teeth where there is wear on the incisal edges or wear facets on the linguals, however little to no wear on posteriors.
- Occlusal guards should be fabricated along with an occlusal analysis in CR on models.

**Flowables?**

- Microleakage and missing fillings from high occlusal loads on teeth can cause large cervical stress concentrations resulting in disruption of the bonds between the hydroxyapatite crystals and the eventual loss of cervical enamel, dentin and restoration.

**RESIN MODIFIED GLASS IONOMER**

- SDI-RIVA LC, LIGHT CURE HV
- G.C. AMERICA–FUJI II LC
- VOCO–IONOLUX AC
- 3M/ESPE–KETAC NANO

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Fig. 15 – Graph representing the mean annual failure rates per adhesive class, determined according to a systematic review of Class-V clinical trials of adhesives during the period 1998–2004 [2].
ABFRACTION LESIONS & CLASS V RESTORATIONS

LATIN WORDS, AB – "AWAY", FRACTION – "BREAKING"

- Pathological loss of tooth structure caused by biomechanical loading forces.
- Static and cyclic flexural overloading of tooth structure ultimately leading to fatigue and failure of tooth structure away from the point of loading.

RESIN MODIFIED GLASS IONOMER RIVA LC/ LC HV (SDI)

RESIN MODIFIED GLASS IONOMER RESTORATION POST-OP PHOTO – NOTICE UNLIKE TYPICAL CLASS V COMPOSITE RMGI RESTORATIVE MATERIAL.

- LIGHT CURED
- DUAL CURED
- HIGH FLEXURAL STRENGTH
- GOOD POLISHABILITY
- EXCELLENT WEAR
- HYDROPHILIC
- FLUORIDE RELEASE
- NO MICROLEAKAGE
- NO ADHESIVES
- ACID RESISTANT LAYER
- REDUCES SENSITIVITY
- TRUE CHEMICAL ADHESION

RESIN MODIFIED GLASS IONOMER

- DENTIN 109-160MPA FLEXURAL STRENGTH
- COMPOSITES CAN HAVE FLEXURAL STRENGTHS OF 65MPA -159MPA
- CHEMFIL ROCK HIGHEST FLEXURAL STRENGTH 63MPA FOR A CONVENTIONAL GI
- FUJI II LC, BOND STRENGTH 21.8MPA FLEXURAL STRENGTH 64-68MPA

ABFRACTION LESIONS
TYPICAL TREATMENT INVOLVES THE PLACEMENT OF A #00 RETRACTION CORD ON EACH TOOTH FOLLOWED BY A SHADE SELECTION. ROUGHEN TOOTH STRUCTURE WITH AIR ABRASION. PLACE CAVITY CONDITIONER ON ALL AREAS TO BE RESTORED FOR 10 SECONDS, THEN WASH AND DRY.

RESIN MODIFIED GLASS IONOMER FUJI II LC (GC AMERICA)

MIX RMGI AND SYRINGE INTO PLACE. UTILIZE HAND INSTRUMENTS TO SHAPE AND REMOVE GROSS EXCESS. CURE EACH TOOTH FOR 20 SECONDS. REMOVE EXCESS AND CONTOUR USING A HANDPIECE WITH FINE DIAMOND BURS. TEETH SHOULD BE ISOLATED FROM SALIVA.

AFTER CONTOURING THE RESTORATIONS CAN BE COATED WITH A SELF-ETCH ADHESIVE COATING, AND CURE FOR 10 SECONDS.

Seven year post-op photos show the integrity of the material is still excellent. Note the lack of marginal microleakage stain often present with composite restorations.
Double Cord Technique

Single Cord Technique

PORTABLE, FAST, EFFICIENT

DIODE LASERS

Laser Troughing

Benefits:
- Predictable margins
- No tissue recession
- No bleeding
- No discomfort
- Faster procedure

Settings:
- Power: 1.2W
- Mode: Continuous
- Tip: Initiated

Tissue Management

Fast

Tissue displacement

Hemostasis

No crevicular fluid

No cord

MAKES LARGE CASES EASY
BOND DEGRADATION


RESIN–DENTIN BONDS ARE NOT AS DURABLE AS WAS PREVIOUSLY THOUGHT. MICROTENSILE BOND STRENGTHS OFTEN FALL 30% TO 40% IN 6 TO 12 MONTHS.
CEMENT OPTIONS

- Glass Ionomers
  - Acidic Ph
  - Moisture tolerant
  - Fluoride release
  - Low bond strength
  - Biocompatibility: Fair
  - Sealing quality: OK

- Resin Modified Glass Ionomers
  - Acidic Ph
  - Insoluble
  - Moisture tolerant
  - Fluoride release
  - Stronger than traditional glass ionomers
  - Decays over time
  - Improved bond strength
  - Biocompatibility: OK
  - Bioactivity: None
  - Sealing quality: OK
  - Ex. Crowns, Gold Inlays & Onlays

- SE Resin
  - Acidic/Neutral Ph
  - Not moisture tolerant
  - Low-moderate initial bond strengths
  - Decreased bond strength over time
  - Water sorption
  - Biocompatibility: OK
  - Bioactivity: None
  - Sealing quality: OK

- Bonding Agent w/ Resin
  - Acidic/Neutral Ph
  - Not moisture tolerant
  - Best initial bond strengths but also decreases w/ time
  - Decreased bond strength over time
  - Water sorption
  - Biocompatibility: OK
  - Bioactivity: None
  - Sealing quality: Good but technique sensitive

FULL COVERAGE CERAMICS AND ZIRCONIA

Ceramic & Zirconia Cementation

WHAT DO YOU USE?
CERAMIR (DOXA)

CEMENT OPTIONS

- ALKALINE PH
- MOISTURE TOLERANT
- SELF SEALING
- APATITE FORMATION
- INSOLUBLE
- STRONGER WITH TIME
- SEMI / TRANSLUCENT
- BIOCOMPATIBILITY-EXCELLENT
- BIOACTIVITY-APATITE FORMATION
- SEALING QUALITY-EXCELLENT

CERAMIR® CROWN & BRIDGE

- CERAMIR C&B IS A MATERIAL THAT COMBINES GLASS Ionomer TECHNOLOGY WITH THE INNOVATIVE CERAMIR (CALCIUM ALUMINATE – C.A.) TECHNOLOGY.
- THE G.I. CONTRIBUTES TO:
  - LOW INITIAL PH, SHORT DURATION
  - FLOW AND SETTING CHARACTERISTICS
  - EARLY STRENGTH
- THE C.A. CONTRIBUTES TO:
  - INCREASED STRENGTH AND RETENTION
  - BIOCOMPATIBILITY
  - SEALING OF TOOTH MATERIAL INTERFACE
  - APATITE FORMATION
  - SUSTAINED LONG TERM PROPERTIES, NO DEGRADATION
  - BASIC END PH

CERAMIR® CROWN & BRIDGE

- CERAMIR CROWN & BRIDGE IS INDICATED FOR PERMANENT CEMENTATION OF:
  - PORCELAIN FUSED TO METAL CROWNS AND BRIDGES
  - METAL (GOLD, ETC.) CROWNS AND BRIDGES
  - GOLDS INLAYS AND ONLAYS
  - CAST OR PREFABRICATED METAL POSTS
  - STRENGTHENED CORE ALL-ZIRCONIA OR ALL-ALUMINA CERAMIC CROWNS AND BRIDGES
  - LITHIUM DISILICATE (EMAX)
  - STAINLESS STEEL CROWNS
  - ORTHO BANDS AND APPLIANCES

IN VITRO TESTS, TEMPLE UNIVERSITY

Compressive strength after 24 hours storage in phosphate buffer at 37°C

<table>
<thead>
<tr>
<th>Material</th>
<th>Strength (Mpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rely X Luting</td>
<td>60 ± 10</td>
</tr>
<tr>
<td>Fuji Plus</td>
<td>118 ± 15</td>
</tr>
<tr>
<td>Rely X Unicem</td>
<td>132 ± 10</td>
</tr>
<tr>
<td>Ceramir C&amp;B</td>
<td>160 ± 27</td>
</tr>
</tbody>
</table>

Results are published in J Dent Res. 2008;87(B):3100 by Jefferies et al.
0% SENSITIVITY
100% RETENTION
100% MARGINAL INTEGRITY
0% RECURRENT DECAY
0% MARGINAL DISCOLORATION

JEFFRIES SR, PAMEIJER CH, APPLEBY DC, BOSTON D, CALBERATH C, LOOF J, GLANTZ P-O.
PROSPECTIVE OBSERVATION OF A NEW BIOACTIVE LUTING CEMENT: 2 YEAR FOLLOW-UP. J PROS.

BIOCOMPATIBILITY STUDIES*

• IN COMPARISON TO ALL OTHER DIRECT DENTAL MATERIALS
  • “CERAMIR CROWN & BRIDGE HAS EXCELLENT BIOCOMPATIBLE PROPERTIES”

• THE ABILITY TO FORM HYDROXYAPATITE CONTRIBUTES TO THE GOOD TISSUE CONSERVING PROPERTIES

• CORNELIS H. PAMEIJER, DMD, DSC, PHD
  • PROFESSOR EMERITUS UNIVERSITY OF CONNECTICUT
  EXPERT REPORT, AUG 2009

Figure 2. Group 1 – 85 days. Higher magnification of Figure 1 showing Ca aluminate capping material in pulp tissue. No inflammation. The material is dispersed in connective tissue of pulp without causing inflammation. (Tooth 1.1; 100X, H&E)

* Summarized in Prof C.H. Pameijer CERAMIR™ CROWN & BRIDGE LUTING AGENT – A TREATISE ON BIOCOMPATIBLE CEMENTATION TECHNIQUE

CEMENTATION TECHNIQUE

LITHIUM DISILLICATE (EMAX)
SUBGINGIVAL MARGIN & PFG

Zirconia Restorations

Lithium Disilicate (eMax)

MISSING CANINE

ZIRCONIA ABUTMENT AND EMPRESS CROWN
• Nano-Structural Integration
• Permanent Seal of the Tooth – Restoration Interface
• Biocompatibility
• Creates apatite when in contact with phosphates
• No shrinkage
• No post-op sensitivity
• Hydrophilic system with alkaline pH
• Chemically stable
• Acid resistant

**CERAMIR® CROWN & BRIDGE**
- Retention equal to or better than resin cements
- Material gets stronger over time & remains stable
- No etching, bonding or conditioning
- Easy seating to completion of indirect restoration
- Easy to clean up
- Does not require optimal conditions for a good seal
- Self sealing

**CERAMIR® CROWN & BRIDGE**
- No post-op sensitivity
- Hydrophilic system with alkaline pH
- Chemically stable
- Acid resistant
VENEER CEMENTATION

REALITY

Choice 2
LITHIUM DISILICATE & SILICATE, LEUCITE AND FELDSPATHIC RESTORATIONS

IS AN ADHESIVE CEMENTATION SYSTEM THAT IS EASY-TO-USE, EFFICIENT AND HIGHLY EFFECTIVE

MIXED TREATMENT CASE
- 20 Y.O. FEMALE PATIENT PRESENTS WITH A MISSING LATERAL INCISOR, PEG LATERAL, WORN DENTITION.
Thank You!
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