References:


PulpDent ACTIV Fluoride Varnish

No allergies
Preventive Care - Sealants

- Hydrophilic Sealants vs. Hydrophobic
  - Much easier to place
  - Less resistant to wear
  - Ability to release amorphous calcium phosphate or fluoride
Diagnosis Friendly Sealants

- Clear for visual inspection
- Clear for use with DIAGNOdent
- Approved by the FDA
- Hydrophilic
- Allows re-mineralization
- Current Research
Diagnosis Friendly Sealants

CLINICAL BRIEFS

A New Therapeutic Pit-and-Fissure Sealant Improves Early Dental Caries Monitoring for Minimally Invasive Dentistry

chart
Preventive Care - Re-mineralize

- Triage

Re-mineralizing sealant instead of invasive occlusal restorations
Preventive Dentistry

- "Sticky" pits will remineralize
- Prevents unnecessary operative dentistry
- Requires parental education
- Same concept as A.R.T.

Preliminary Evidence of Mechanical Recovery of ART Treated Carious Dentin

L.E. BERTASSONI1, R. STANISLAWSKI2, R. MOSS3, M.L. CANNON4, S. HABELITZ1, S.J. MARSHALL1, and G.W. MARSHALL5, 1University of California - San Francisco, San Francisco, CA, 2University of California, San Francisco, San Francisco, CA, 3University of California - San Francisco, Berkeley, CA, 4Northwestern University, Chicago, IL, 5University of California San Francisco, San Francisco, CA

Atraumatic restorative treatment technique consists of hand excavation of carious dentin and preservation of sound tissues that might be suitable for remineralization after restoration with glass ionomer (GI) cement. ART restorations allow fluoride release over their lifetime, thus favoring remineralization, but little information exists about the mechanical recovery of treated tissues and the depth of remineralization under ART restorations. Objective: This pilot study sought to provide preliminary data on the clinical effectiveness of ART in remineralizing and recovering the mechanical properties of carious dentin. Methods: Twelve teeth prepared by the same practitioner were obtained, gamma-irradiated, embedded and subsequently cross-sectioned to expose the inner surface of the teeth and the interface between the glass ionomer and the treated dentin. Simulated caries lesions in dentin substrates (12mm2) were used as a control. Representative specimens (n=5) of the ART teeth and the control had their elastic-modulus determined by AFM-based nanoindentation in water. 2 lines containing 30-40 indents with an interval of 2 um between each was performed across the dentin-GI interface extending into dentin. Data was analyzed using ANOVA (P < .05). Additionally, specimens (n=7) were embedded, cross-sectioned and metallographically prepared to obtain 100 um thick samples for subsequent imaging with a polarized light microscope (PLM). Results: Elastic-modulus of ART treated dentin was not significantly different from normal dentin through the extension of the indented area; yet, ART yielded properties significantly higher than the control group until a depth of about 20 um. It was also noted that full mechanical recovery was not homogeneously distributed along the areas measured. PLM images suggested similarities between the inner-most affected zone of the simulated caries with the dentin right under the GI. Conclusion: This study suggested that the clinical application of ART might facilitate remineralization and provide the mechanical recovery of treated carious dentin. Supported: NIH DE16849
Sealant- developments

“Triage” patients
Preventive Dentistry
In Situ Evaluation of the Remineralizing Capacity of Pit-and-Fissure Sealants Containing Amorphous Calcium Phosphate and/or Fluoride.

KÉLIO GARCIA SILVA, DDS, MS, PHD, POST GRADUATION PROGRAM IN PEDIATRIC DENTISTRY, UNESP – SÃO PAULO STATE UNIVERSITY, ARAÇATUBA DENTAL SCHOOL, SP, BRAZIL.
DENISE PEDRINI, DDS, MS, PHD, PROFESSOR, DEPARTMENT OF SURGERY AND INTEGRATED CLINIC, UNESP – SÃO PAULO STATE UNIVERSITY, ARAÇATUBA DENTAL SCHOOL, SP, BRAZIL.
ALBERTO CARLOS BOTAZZO DELBEM, DDS, MS, PHD, PROFESSOR, DEPARTMENT OF CHILD AND SOCIAL DENTISTRY, UNESP – SÃO PAULO STATE UNIVERSITY, ARAÇATUBA DENTAL SCHOOL, SP, BRAZIL.
MARK CANNON, DDS, MS, CHILDRENS’ MEMORIAL HOSPITAL, NORTHWESTERN UNIVERSITY, CHICAGO IL, USA.
LILIAN FERREIRA, DDS, POSTGRADUATE STUDENT, POST GRADUATION PROGRAM IN PEDIATRIC DENTISTRY, UNESP – SÃO PAULO STATE UNIVERSITY, ARAÇATUBA DENTAL SCHOOL, SP, BRAZIL.
Purpose:

- The purpose of this study was to evaluate *in situ* the re-mineralizing potential of pit-and-fissure sealants containing ACP and/or fluoride in artificially induced carious lesions on smooth enamel surfaces.
Materials and Methods:

- Ten young adults (5 men and 5 women) aged 20 to 29 years with normal non-stimulated salivary flow (≥0.2 mL/min) were enrolled in this study.
- The study design was independently reviewed and approved by the Research Ethics Committee of the Dental School of Araçatuba, UNESP, Brazil.
Enamel slabs (4x4x2 mm) were obtained from bovine incisor teeth.

Two hundred enamel slabs with an average SMH₁ between 320 and 360 KHN were selected for the study.
✓ Enamel Blocks 4x4x2 mm
The enamel surface was polished and the slabs were cross-sectioned at 1 mm from the border resulting in specimens with 4x3x2 mm.
Materials and Methods (cont.):

- Forty specimens were prepared for the control and each tested sealant [Fluroshield (Dentsply International Inc, Milford, DE, USA; with fluoride); Aegis (Bosworth, Skokie, IL, USA; with ACP); experimental sealant containing fluoride (ESF) (Bosworth); and experimental sealant containing ACP and fluoride (ACP-F) (Bosworth)] using a metallic matrix (4x2x1 mm).
Materials and Methods (cont.):

- Acrylic intraoral removable palatal devices were constructed with 4 cavities, being two in the region of the 2nd premolar (one right, one left) and two in the region of the 1st molar (one right, one left).
Figure 2. Integrated mineral recovery area ($\Delta Z$) (mean $\pm$ se, n=10) according to the distance of indentation from enamel border in contact with the material.
Conclusion:

In conclusion, the sealants containing amorphous calcium phosphate and/or fluoride were able to promote remineralization of artificially induced carious lesions on smooth enamel surfaces.

ACKNOWLEDGEMENTS

This study was supported by CAPES. The authors thank Bosworth for donation of some materials used in the research.
New Sealant Technology

In Vitro Evaluation of a Highly-Cross-Linking Pit and Fissure Sealant

M.L. CANNON1, K. GARCIA2, D. BARSTAD2, L. CHEN3, S. MAUSHMI3, and B. SUH3

1Suite #308, Grove Medical Center, Long Grove, IL, 2Pediatric Dentistry, Children’s Hospital Medical Center, Chicago, IL, 3Research and Development, BISCO, Inc, Schaumburg, IL

Objectives:

A new proprietary resin has been developed that polymerizes at many cross linking connections resulting in less water diffusion and less oxygen inhibition of surface polymerization. The purpose of this study is to compare the physical properties of this new experimental sealant to current commercial products.

HAPISeal

Hydrophilic
Adhesion promoted
Polymerizing with highly cross linking multi-functional
Inhibition of plaque adhesion
Sealant

and less oxygen inhibition of surface polymerization. The purpose of this study is to compare the physical properties of this new experimental sealant to current commercial products.
## New Sealant Technology

### Results:
Mean enamel bond strength and surface microhardness (standard deviation) are shown in the Table below. Means with different letters in the same column are statistically different (p<0.05).

<table>
<thead>
<tr>
<th>Sealant</th>
<th>Shear bond strength, MPa</th>
<th>MicroHardness</th>
<th>Elasticity, GPa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Sealant (Bisco)</strong></td>
<td></td>
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</tr>
<tr>
<td>HAPISeal</td>
<td>32.2 (1.9)a</td>
<td>151.7 (48.5)a</td>
<td>6.8 (1.4)bc</td>
</tr>
<tr>
<td>Clinipro (3M ESPE)</td>
<td>17.0 (2.2)c</td>
<td>55.9 (13.5)d</td>
<td>2.5 (1.2)e</td>
</tr>
<tr>
<td>Delton FS+ (Dentsply)</td>
<td>26.5 (5.8)ab</td>
<td>123.2 (12.8)a</td>
<td>7.7 (0.4)b</td>
</tr>
<tr>
<td>Pulpdent Corp (Embrace)</td>
<td>20.9 (6.8)bc</td>
<td>73.9 (4.2)c</td>
<td>7.2 (0.3)c</td>
</tr>
<tr>
<td>Ultraseal XT Plus (Ultradent)</td>
<td>21.0 (7.0)bc</td>
<td>135.1 (12.6)a</td>
<td>9.5 (0.3)a</td>
</tr>
<tr>
<td>Fortify Plus (Bisco Composite Sealant)</td>
<td>20.7 (3.3)bc</td>
<td>96.6 (7.2)b</td>
<td>5.3 (0.9)d</td>
</tr>
</tbody>
</table>
Micro-leakage evaluation:

Extracted premolars were obtained and stored in 1% thyamine solution for 72 hours. The teeth were prepared for sealant application in the same manner as is typically used in clinical practice.

Prophylaxis with rubber cup and pumice. Etch for 30 seconds and rinsed for 10 seconds. Sealant applied with micro-brush and light cured for 20 seconds.
Micro-leakage evaluation:

- The specimens were stored in 2% methylene blue solution for 72 hours then sectioned with Buehler Isomet saw for microleakage evaluation.
- Sections were compared to control hydrophilic sealant, (Pulpdent) Embrace.
- Results: Both sealants displayed acceptable resistance to micro-leakage.
New Sealant Technology

- Micro-leakage with 2% methylene blue solution.
New Sealant Technology

Discussion: HAPISeal

- Pit and Fissure sealants that have improved properties, such as:
  - Hydrophilic on placing
  - Hydrophobic upon polymerization
  - More resistant to wear and chipping
  - Possibly have anti-microbial effect

Would be more readily placed by the dental profession and accepted by all practitioners.
Conclusions: The experimental sealant's improved bond strength and surface hardness were statistically significant (p<0.05) compared to current commercial products.
New Sealant Technology

- Bis Phenol A - IS BACK IN THE NEWS!!!
New Sealant Technology

- Bis Phenol A is back in the news!!

BPA's possible role in miscarriages


Dental composite fillings and bisphenol A among


Bisphenol A blood and saliva levels prior to and after dental sealant placement in adults.

Zimmerman-Downs JM, Shuman D, Stull SC, Ratzlaff RE.

College of Health Sciences, Old Dominion University, Norfolk, VA, USA.
New Sealant Technology

- Bis Phenol A - IS BACK IN THE NEWS!!!


Bisphenol A and peripheral arterial disease: results from the NHANES.


Relationship between urinary bisphenol A levels and prediabetes among subjects free of diabetes.


Relationship between urinary bisphenol A levels and diabetes mellitus.

Shankar A, Teppala S.

Department of Community Medicine, West Virginia University School of Medicine, P.O. Box 9190, Morgantown, West Virginia 26506-9190, USA. ashankar@hsc.wvu.edu
Does BPA change biofilm?

**Estrogenic Activity of Bisphenol A and 2,2-bis(p-Hydroxyphenyl)-1,1,1-trichloroethane (HPTE) Demonstrated in Mouse Uterine Gene Profiles**

Sylvia C. Hewitt and Kenneth S. Korach

---

**In vitro Estradiol Hemisuccinate Activity as anti Vaginal Microbiota Biofilm Strategy**

M. Marques, A. Farinati, M. Arcos, L. Sibert, A. Orsini

USAL, Buenos Aires, ARGENTINA
Helicobacter pylori infection is associated with an increased rate of diabetes.

Center for Infectious Diseases Epidemiologic Research, Mailman School of Public Health, Columbia University, New York, New York, USA.

Abstract
OBJECTIVE: Chronic infections could be contributing to the socioeconomic gradient in chronic diseases. Although chronic infections have been associated with increased levels of inflammatory cytokines in cardiometabolic risk, there is limited evidence on how infections affect risk of diabetes.

RESEARCH DESIGN AND METHODS: We examined the association between serological evidence of chronic viral and bacterial infections and incident diabetes— an objective corollary of Diabetes. We analyzed data on 72 individuals aged 30 years and diabetes free in 1998-1999, whose blood was tested for antibodies to herpes simplex virus 1, varicella virus, cytomegalovirus, Helicobacter pylori, and Toxoplasma gondii and who were followed until June 2008. We used Cox proportional hazards regression to estimate the relative incidence rate of diabetes by serostatus, with adjustment for age, sex, education, cardiovascular disease, smoking, and income levels.

RESULTS: Individuals seropositive for herpes simplex virus 1, varicella virus, cytomegalovirus, and T. gondii did not show an increased rate of diabetes, whereas those who were seropositive for H. pylori at enrollment were 2.7 times more likely at any given time to develop diabetes than seronegative individuals (hazard ratio 2.69 [95% CI 1.10-6.60]). Controlling for insulin resistance, C-reactive protein and interleukin-6 did not attenuate the effect of H. pylori infection.

CONCLUSIONS: We demonstrated for the first time that H. pylori infection leads to an increased rate of incident diabetes in a prospective cohort study. Our findings implicate a potential role for antibiotic and gastrointestinal treatment in preventing diabetes.
THE SECRETS!!! SHHHHHHH!!!

- Manufacture Dependent For Levels of Bis Phenol A
  - Three methods to make Bis GMA
    - Reaction of two moles of glycidyl methacrylate with one mole of bisphenol a.
    - Condensation of sodium salt of bisphenol a with glycidyl methacrylate and anhydrous hydrochloric salt
    - Reaction of glacial methacrylate acid with the diglycidyl ether of bisphenol and a tertiary amine
  - No Bis GMA in product
Saliva Testing
OralDNA Labs

- DNA (bacterial) Testing (MyPerioPath) establishes bacterial risk and can help guide therapy based on causation.
- DNA (genetic) Testing (MyPerioID PST®) establishes genetic risk and can help guide therapy based on genetics.
- DNA (viral) Testing (OraRiskHPV) identifies HPV status (separate risk factor for oral cancers).

Minneapolis MN clinical laboratory (was Nashville TN)

---

**2100 Gastrointestinal Function Profile**

<table>
<thead>
<tr>
<th>Predominant Bacteria</th>
<th>(E+007)</th>
<th>95% Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obligate anaerobes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacteroides sp.</td>
<td>4.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Clostridia sp.</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Prevotella sp.</td>
<td>3.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Fusobacteria sp.</td>
<td>2.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Streptomyces sp.</td>
<td>3.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Mycoplasma sp.</td>
<td>1.7</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Facultative anaerobes</strong></td>
<td></td>
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</tr>
<tr>
<td>Lactobacillus sp.</td>
<td>3.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Bifidobacter sp.</td>
<td>4.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>
- Determines who is at risk!
- Treat more aggressively
- Interleukin 1A and 1B
- 30-40% of Caucasian

<table>
<thead>
<tr>
<th>Test</th>
<th>Genotype</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL-1A (+4865)</td>
<td>G/T</td>
<td>PST-positive genotype for severe periodontal disease.</td>
</tr>
<tr>
<td>IL-1B (+1954)</td>
<td>G/T</td>
<td>PST-positive phenotype for increased susceptibility to periodontal disease.</td>
</tr>
</tbody>
</table>

Interpretation:
The results of the PST test indicate that your patient is POSITIVE and has an increased risk for more severe periodontal disease due to the genetic variations examined in this test. PST-positive patients may require more aggressive treatment.

Risk:
- **Prevalence:** The prevalence of the PST-positive genotype ranges from 30 to 40% in Caucasian populations. This frequency may be different in other ethnic groups. It is important to note that whenever the PST-positive genotype is present, it is associated with increased susceptibility to periodontal disease and overproduction of IL-1, a cytokine that amplifies inflammation.
- **Consider:** The PST test assesses one of several risk factors that should be included in an overall evaluation of periodontal disease. Specific factors are associated with the initiation of the disease, and additional risk factors including genetic susceptibility, smoking, diabetes, and oral hygiene have an amplifying effect on periodontal disease progression.
Positive when pathogenic bacteria reported above threshold

Just change the oral environment!!
Age One Test
Ideally Recommended by ADA, AAPD and AAP
Sterile saline on Toothette swab
- Streptococcus mutans
- Lactobacillus acidophilus
- Nocardia ssp
- Streptococcus sobrinus
- Actinomyces viscosus

KLK4 or OPN genotypes?

DNA testing only once!
# Pediatric Dentists’ Diagnostic plan

**Recommended Immunization Schedule for Persons Aged 0 Through 6 Years**—United States • 2010

For those who fall behind or start late, see the catch-up schedule

<table>
<thead>
<tr>
<th>Vaccine ▼</th>
<th>Age ►</th>
<th>Birth</th>
<th>1 month</th>
<th>2 months</th>
<th>4 months</th>
<th>6 months</th>
<th>12 months</th>
<th>15 months</th>
<th>18 months</th>
<th>19–23 months</th>
<th>2–3 years</th>
<th>4–6 years</th>
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<tbody>
<tr>
<td>Hepatitis B¹</td>
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<td>HepB</td>
<td>HepB</td>
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<td>Rotavirus²</td>
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<tr>
<td>Diphtheria, Tetanus, Pertussis³</td>
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<tr>
<td>Haemophilus influenzae type b⁴</td>
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<td>Pneumococcal⁵</td>
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<td>Inactivated Poliovirus⁶</td>
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<td>Influenza⁷</td>
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<tr>
<td>Measles, Mumps, Rubella⁸</td>
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<tr>
<td>Varicella⁹</td>
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<tr>
<td>Hepatitis A¹⁰</td>
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<tr>
<td>Meningococcal¹¹</td>
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</tbody>
</table>

- **Range of recommended ages for all children except certain high-risk groups**
- **Range of recommended ages for certain high-risk groups**

**Follow Schedule**
Treating a bacterial disease as a bacterial disease!

Creation of a healthy oral biofilm by restoring nature's balance

Millions of children placed into a schedule of appropriate testing and intervention.

Medical Model for Care - test for who is susceptible

In Summary

Testing!! Better Diagnosis Targeted Population Effective Treatment

-Treating a bacterial disease as a bacterial disease
-Creating a healthy oral biofilm by restoring nature's balance
-Million children placed into a schedule of testing and intervention

SPEAKING OF GENETICS!
“Do not follow where the path may lead. Go instead where there is no path and leave a trail.”

- Harold R. McAlindon
In pediatric dentistry...

- Total Patient Care
- All treatment should include preventive care and concern for emotional health
- All treatment should be conservative and esthetic by design

22-24% of Northern Europeans

Factors affecting the distribution of enamel hypoplasias within the human permanent dentition. Amerindians - 0.7 to 1.27 defects per anterior

Molar Incisor Hypomineralization

3 times the prevalence of dental erosions in primary teeth than permanent with Brisbane kids Ped Dent 2007

- Not associated with fluoride
- Genetic etiology
- Possibly 10,000 genes involved
- Disruption in protein needed for enamel development

Knockout & Knockin Mouse Services

We generate knockout, conditional knockout or knockin mice by homologous recombination. Services include knockout vector construction, ES cell electroporation and screening, blastocyst injection, and genotyping/breeding of chimeras and F1 mice.

Nuclease-mediated Knockout Mouse Services

Traditional recombination-based knockout mice can take close to a year to make. If you cannot wait that long, please consider our nuclease-mediated knockout mouse services, which take just a few months and also cost less.
The relationship of enamel defects and caries: a cohort study.

Targino AG, Rosenblatt A, Oliveira AF, Chaves AM, Santos VE.
Department of Clinical and Social Dentistry, Federal University of Paraiba, João Pessoa, Brazil. rosen@nlink.com.br

Abstract

OBJECTIVE: Is there a relationship between enamel defects and early childhood caries?

METHODS: A total of 275 children participated in a cohort study from birth to 54 months of age. Enamel defects were determined by the development defects enamel index and dental caries was registered according to the WHO criteria. Data were analyzed using descriptive, analytical techniques, multivariate analysis, and evidence-based tools as number needed to harm (NNH).

RESULTS: In the follow up, 224 children were still in the study, 81.3% presented at least one tooth with enamel defect and 44.2% had dental caries. An association was found between enamel defects and dental caries (P = 0.0091). Multivariate analysis showed that night bottle-feeding, absence of fluoride and enamel defects were predictors of dental caries at 18 months (P < 0.05). Enamel defect was the only statistically significant variable to influence the development of caries at 24, 30, 36, and 42 months. At 48 months, the use of fluoride toothpaste had effect on the decrease of caries (P < 0.05). The NNH for enamel defects in relation to dental caries was 3.0, at 24 months and 5.0 at 54 months.

CONCLUSION: Enamel defect is a predisposing factor for ECC.

• “Enamel defect is a predisposing factor for ECC”
“Enamel defects strongly associated with ECC.”
Molar Incisor Hypoplasia

**Abstract**

We propose a new classification for Molar Incisor Hypoplasia (MIH). The severity of MIH affects mostly young children and adolescents. These patients have a range of dental caries and dentists often have difficulties in assessing the dental health. Researchers consider the EHP (Early Hypoplasia of the Permanent Teeth) score as an indicator for infant and maternal stresses.

**Graph**

![Graph showing mean dfs by age in years](image)

- **Mean dfs**
  - Yakima, 1988
  - NIDR, 1986-87

**Age in years**

- 6
- 7
- 8
- 9
- 6–9

**Data**

- 0
- 2
- 4
- 6
- 8
- 10
- 12

- "EHP an indicator for infant and maternal stresses"
• Not at all what we previously thought! Scardovia wiggsiae?
Microbiota of severe early childhood caries before and after therapy.

Tanner AC, Kent RL Jr, Holgersson PL, Hughes CV, Loo CY, Kanaei E, Chalmers NI, Johansson I.
Department of Molecular Genetics, The Forsyth Institute, 245 First Street, Cambridge, MA 02142, USA. annetanner@forsyth.org

Abstract
Severe early childhood caries (ECC) is difficult to treat successfully. This study aimed to characterize the microbiota of severe ECC and evaluate whether baseline or follow-up microbiotas are associated with new lesions post-treatment. Plaque samples from 2- to 6-year-old children were analyzed by a 16S rRNA-based microarray and by PCR for selected taxa. Severe-ECC children were monitored for 12 months post-therapy. By microarray, species associated with severe-ECC (n = 53) compared with caries-free (n = 32) children included Slackia exigua (p = 0.002), Streptococcus parasanguinis (p = 0.013), and Prevotella species (p < 0.02). By PCR, severe-ECC-associated taxa included Bifidobacteriaeae (p < 0.001), Scardovia wiggsiae (p = 0.003), Streptococcus mutans with bifidobacteria (p < 0.001), and S. mutans with S. wiggsiae (p = 0.001). In follow-up, children without new lesions (n = 36) showed lower detection of taxa including S. mutans. Changes not observed in children with follow-up lesions (n = 17). Partial least-squares modeling separated the children into caries-free and two severe-ECC groups with either a stronger bacterial or a stronger dietary component. We conclude that several species, including S. wiggsiae and S. exigua, are associated with the ecology of advanced caries, that successful treatment is accompanied by a change in the microbiota, and that severe ECC is diverse, with influences from selected bacteria or from diet.

- Scardovia wiggsiae and Slackia exigua associated with advanced decay (S-ECC)
Total Patient Care...

- **Preventive Care**
  - Fluoride varnish
  - MI Paste

- **Anterior Composites**
  - Flowable
  - 7th generation adhesive

Genetic issues, enamel hypoplasias
Proper Testing is essential!
Pulpal Protection
Maintaining Hybrid Layer
Preventing Microleakage
TheraCal
the innovative light-curable Calcium Silicate-based pulp-capping material
Pulp Capping with Dentin bonding Agents

Clearfil Liner Bond 2 And Scotchbond Multi-purpose

20 teeth pulp capped And extracted 30-90 days

Ca(OH)2 less cytotoxic, less inflammation

Department of Morphology, Institute of Biological Sciences, Belo Horizonte, Brazil.

This study evaluated the efficacy of the Single Bond Adhesive System (SBAS) with 37% phosphoric acid etching (Group I) or 10% phosphoric acid etching (Group II) in conjunction with Calcium Hydroxide (CH). The degree of bleeding was assessed after cavity preparation under local anesthesia. The pulps of 78 sound premolars were capped with SBAS after 37% phosphoric acid etching (Group I) or 10% phosphoric acid etching (Group II) and CH (Group II control). The cavities were restored with a resin composite (Charisma). After 30 days, all patients were clinical and radiographic examination for leakage and vital signs were performed. Patients in Group I showed the presence of hemostasis with saline solution only. There was no statistical difference between bleeding generated by 10% and 37% acid solutions. In some cases, contact of the pulp tissue with SASB started the bleeding process, thus damaging the adhesive technique. The histological response was different for the two groups. In Group I, a cementum-like tissue up to 30 days was observed. In Group II, CH showed a more intense tissue response and positive underneath the area of coagulation necrosis. Dentin bridging was observed at the 30th day. The postoperative period was asymptomatic for all groups. In conclusion, SBAS should be avoided for vital pulp therapy, while CH remains the capping agent of choice for mechanically exposed human dental pulp.

Ca(OH)₂ remains agent of choice.
1. Avoid exposing the pulp. The chances for tooth survival are excellent if the tooth is asymptomatic and well sealed, even if residual caries remains.

2. Control hemorrhage with water, saline or sodium hypochlorite. Water and saline are the most benign to the pulp; sodium hypochlorite is best at controlling hemorrhage and disinfecting.

3. ZOE, GI/RMGI and adhesives are poor direct pulp-capping agents and should be avoided for this application.

4. MTA demonstrates comparable results to calcium hydroxide as a direct pulp cap agent in short-term data.

5. Calcium hydroxide remains the “gold standard” for direct pulp capping. It has the longest track record of clinical success, is the most cost-effective and is the likely effective component in MTA.

6. Provide a well-sealed restoration immediately after pulp capping. This will provide protection against ongoing leakage and bacterial contamination that can compromise the success of the pulp cap.
Effect of polyacrylic acid on the apatite formation of a bioactive ceramic in a simulated body fluid: fundamental examination of the possibility of obtaining bioactive glass-ionomer cements for orthopaedic use. **Kawashita M, Kokubo T, Nakamura T.**

*Biomaterials.* 2001 Dec;22(23):3191-6.

“PAA inhibits the apatite formation in the body environment. It is speculated that when glass-ionomer cements are implanted into the body, PAA can be released from the glass-ionomer cements and inhibits the apatite formation on their surfaces. It is reasonable to suppose that this will occur with any glass-ionomer cement that contains PAA. Therefore, it might be considered difficult to obtain bioactive glass-ionomer cements”
### Ability to Sustain Alkalinity Over Time

<table>
<thead>
<tr>
<th>TheraCal</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Dycal</th>
<th>Dycal VLC</th>
<th>Room Stability (No separation)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
<td><strong>pH</strong></td>
<td><strong>pH</strong></td>
<td><strong>pH</strong></td>
<td><strong>pH</strong></td>
<td><strong>pH</strong></td>
<td></td>
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<td>1</td>
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<td>10.911</td>
<td>11.288</td>
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<td>28</td>
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<td>8.606</td>
<td>9.667</td>
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<td>9.21</td>
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<td>(Crumbled)</td>
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<td>7.95</td>
<td></td>
<td>7.90</td>
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</table>
IADR 2011 Abstract #2520 Gandolfi et al.
Apatite-forming ability of TheraCal pulp capping material

IADR 2011 Abstract #2521 Gandolfi et al.
Chemical-physical properties of TheraCal pulp capping material
Conclusions: TheraCal was able to induce the formation of apatite and represents a promising material in direct pulp-capping clinical procedures. The ability to form apatite may play a critical/positive role in new dentine formation.
### Ca\(^{2+}\) Ion Release (ppm)

<table>
<thead>
<tr>
<th></th>
<th>Calcium Released In Soaking Water (ppm)</th>
<th>(n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 hrs</td>
<td>1 day</td>
</tr>
<tr>
<td>TheraCal</td>
<td>74.7 (9.2)</td>
<td>37.4 (4.5)</td>
</tr>
<tr>
<td>Control</td>
<td>1.2 (0.3)</td>
<td>0.5 (0.4)</td>
</tr>
<tr>
<td>ProRoot</td>
<td>32.2 (4.5)</td>
<td>29.8 (3.5)</td>
</tr>
</tbody>
</table>

### pH changes

<table>
<thead>
<tr>
<th></th>
<th>pH of Soaking Water (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 hrs</td>
</tr>
<tr>
<td>TheraCal</td>
<td>10.96 (0.03)</td>
</tr>
<tr>
<td>Control</td>
<td>6.96 (0.19)</td>
</tr>
<tr>
<td>ProRoot</td>
<td>11.52 (0.75)</td>
</tr>
<tr>
<td>Water</td>
<td>6.88 (0.04)</td>
</tr>
</tbody>
</table>

IADR 2011 Abst. #2521 Gandolfi et al.
Biocompatibility of Dental Materials

Cytotoxic Effects of Resin-Based L/C Pulp Capping Materials Applied on the Immortalized Odontoblast Cell Line MDPC-23

Prof. Dr. Carlos Alberto de Souza Costa
Araraquara School of Dentistry – Unesp
Departament of Physiology and Pathology
1. **TheraCal** (Bisco) – MTA (“Portland” Cement) based resin
2. **Ultra-Blend Plus** (UltraDent) – Ca (OH)$_2$ based resin
3. **Vitrebondd** (3M/ESPE) – Resin modified glass ionomer
4. **DMEM** (Dulbecco’s Modified Eagle Medium) – Control (complete culture medium)
TheraCal presented the lowest decrease in cell metabolic activity

Figure 1. Succinic dehydrogenase (SDH) production detected by the MTT assay according to the groups and extract aging. Letters allow comparison among groups within the same period. Bars indicated by the same letter do not differ statistically (Mann-Whitney, p>0.05). Asterisks indicate statistical difference between periods within the groups (Mann-Whitney, p<0.05).
TheraCal presented the lowest suppression of cell protein expression

Figure 2. Total protein expression (μg/mL) according to the groups and extract aging. Letters allow comparison among groups within the same period. Bars indicated by the same letter do not differ statistically (Mann-Whitney, p>0.05). Asterisks indicate statistical difference between periods within the groups (Mann-Whitney, p<0.05).
Bioactivity and Dental Materials

DIAGNOdent reading of 68 Odd radiolucency on radiograph
"Giant tubular dentin" defect in mesial fossa.

Figure 3. Transverse demineralized section of a non-erupted human deciduous incisor tooth showing dentinal tubule holes (small arrow), giant tubules (large arrow), and interglobular dentin (*). Picosirius. Original magnification: 250X.
Selective etching of enamel for 30 seconds followed by application of semi-gel to dentin for 3-5 seconds

Uni-Etch with BAC
Bioactivity and Dental Materials

TheraCal DC placed on affected dentin for re-mineralization
ALLBond Universal DC (Bisco) - dual cure for deep preparations and undercut areas
Bioactivity and Dental Materials

When equal amounts are mixed it turns pink- self etching and also provides hemostasis.
ALLBond Universal DC applied to preparation creates glossy appearance to TheraCal DC
Light cure for ten seconds at 500 milliwatts/cm$^2$
Bioactivity and Dental Materials

Glossy appearance of properly placed TheraCal DC
A dual cure Liner/base is injected into the cavity preparation.
Bioactivity and Dental Materials

The dual cured Liner/Base is teased into place with an explorer tine
Bioactivity and Dental Materials

Light cured-pulse and allowed to auto cure to reduce polymerization stress
Liner/base placed should be a Dentin replacement - biomemetic - bioactive - biofunctional
Bioactivity and Dental Materials

Restoration completed by placement of a nano-hybrid restorative material, replacing the enamel.
Bioactivity and Dental Materials

Rubber dam removed and occlusion checked - Restoration polished.
Carious Pulp Exposure

- Pulp exposure
- Not symptomatic
- All decay removed
• TheraCal applied
• Thin layer - can see blush through it

resin based tricalcium silicate and dicalcium silicate
• Six month recall
• Totally asymptomatic
• Marginal integrity quite good
Six years later
Still totally asymptomatic
Marginal integrity still excellent
ALLBOND2 and Aelite LS
• Complicated profound crown fracture
• Pinpoint exposure of less than one hour duration - non bleeding
• Complicated profound crown fracture
• Exposure protected by TheraCal
• Fragment re-attached
Complicated profound crown fracture

GlasSpan splint applied for lateral luxation of adjacent Central incisor.
Objectives: The purpose of this study was to evaluate the effect of three novel pulp capping compounds on the growth of immortalized murine pulp cells (OD21).

Methods: Light-cured discs (D=10mm x 1mm) of TheraCal LC (LC), TheraCal DC (Experimental mixture DC) and TheraBag65 LC (Experimental mixture TB3) were soaked in Dulbecco's Modified Eagle Medium (DMEM) for 4 days at 37°C. The discs were removed and the extraction solution was filtered and supplemented with 10% Fetal Bovine Serum. OD21 cells were placed into 24-well culture plates at 10K cells/well and allowed to grow for 24 hours in control media at 37°C 5% CO₂. Wells (N=5 each) were treated once (24 hours), or twice (24 and 48 hours) with extract media and followed over a four day period for the once-treated group, or over three days for the twice-treated group. Cells grown in standard α-MEM with FBS were used as a control. Cell growth/number was assessed by culturing the cells for 1 hour daily in 10% AlamarBlue media and measuring the metabolic product using a fluorescent microplate reader. Percentages of control fluorescence were compared using ANOVA with α=0.05.

Results: The cell growth/number (standard deviations) after one and two treatments are shown in the figures below. Differences were examined by ANOVA with α=0.05.

Conclusions: At every time point, cell survival following the first treatment with all three materials tested, were all similar and greater than 80%. The Day3 cell survival rate following the second treatments showed differences between materials, with DC and TB superior to LC, however by day 4, only DC remained significantly different from the other two materials. All three materials tested were not detrimental to OD21 cells.
Discs of TheraCal LC® (1mm x 10mm) made in custom molds
- Light-cured for 40 seconds each side
- Soaked in fresh SBF (6ml) for up to 10 days
- Disc surfaces were gently scraped and mixed with KBr to make FT-IR samples
Fourier transform spectroscopy is a measurement technique whereby spectra are collected based on measurements of the coherence of a radiative source, using time-domain or space-domain measurements of the electromagnetic radiation or other type of radiation.

Preliminary FT-IR results suggest confirmation of bioactivity
• Discs of TheraCal LC® (1mm x 10mm) made in custom molds
• Light-cured for 40 seconds each side
• Soaked in fresh SBF and RO water (6ml) for up to 6 days
• Fluid was analyzed for Ca ion using an ion selective electrode
Initial ISE results indicate that ions release rapidly and then slowly & continuously.

PPM ion release into water

• Research by Dr. John Mitchell
What is the Ca$^{2+}$ concentration released from the three materials over 4 days into 5 ml?

- TheraCal LC: 140.0 ± 1 ppm
- TheraCal DC: 78.7 ± 4 ppm
- TheraCal BAG: 108.3 ± 5 ppm

measured by ICP-MS

• Calcium concentration highest from TheraCal LC - but is that the desired result? What is sufficient? Or too much?

• Research by Dr. John Mitchell
### Cell metabolic activity as a percent of control (SD)

<table>
<thead>
<tr>
<th>Treated once</th>
<th>1 Day N=20</th>
<th>2 Day N=5</th>
<th>3 Day N=5</th>
<th>4 Day N=5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TheraCal LC</strong></td>
<td>0.93 (0.02)&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>0.84 (0.1)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.91 (0.08)&lt;sup&gt;be&lt;/sup&gt;</td>
<td>0.93 (0.07)&lt;sup&gt;cd&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>TheraCal DC</strong></td>
<td>0.95 (0.03)</td>
<td>0.95 (0.07)&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>1.01 (0.12)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0.96 (0.02)&lt;sup&gt;de&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>TheraCal BAG</strong></td>
<td>0.89 (0.04)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.93 (0.07)&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>1.06 (0.16)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>0.91 (0.07)&lt;sup&gt;be&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

- **Research by Dr. John Mitchell**

- Cell metabolic activity is actually BETTER than control at 3 days for both TheraCal DC and TheraBAG

- **Cell metabolic activity as a percent of control (SD)**

- **TheraCal LC**
  - 1 Day: 0.93 (0.02)
  - 2 Day: 0.84 (0.1)
  - 3 Day: 0.91 (0.08)
  - 4 Day: 0.93 (0.07)

- **TheraCal DC**
  - 1 Day: 0.95 (0.03)
  - 2 Day: 0.95 (0.07)
  - 3 Day: 1.01 (0.12)
  - 4 Day: 0.96 (0.02)

- **TheraCal BAG**
  - 1 Day: 0.89 (0.04)
  - 2 Day: 0.93 (0.07)
  - 3 Day: 1.06 (0.16)
  - 4 Day: 0.91 (0.07)
Cell metabolic activity as a percent of control (SD)

- TheraCal LC
- TheraCal DC
- TheraCal BAG

Research by Dr. John Mitchell
• Research by Dr. John Mitchell

• DAY 4- LC, DC and BAG- confocal microscopy- one treatments
Numerous Studies

TheraCal

Primate premolar section - example
Results:

- TheraCal
- Light Cured

Very little if any inflammation and good hard tissue bridge formation
Results:

- Glass Ionomer Cement

Some bridging inflammatory cells
Results:

- Visible Light Cured Dycal

Very poor dentin bridging
Some Inflammatory infiltrate and vacuoles
Results:

- Two evaluators with data compared (good agreement)
- 44 specimens ranked for inflammation
- 48 specimens examined for hard tissue bridge formation (44 were sectioned and 4 were by microCT)

Inflammation Ranks - based on hyperemia, presence of giant cells and necrosis

- 0 - no inflammation
- 1 - mild inflammation
- 2 - moderate inflammation
- 3 - severe inflammation
- 4 - abscess formation

Bridge Ranks - based on completeness and organization of bridge formation

- 0 - no presence of bridging
- 1 - slight formation, mostly soft tissue
- 2 - moderate amount of bridge, irregular
- 3 - hard tissue bridge, regular and complete
- 4 - hard tissue bridge with apparent odontoblasts, tubules present
Results:

• **Histological Results - Inflammation**

<table>
<thead>
<tr>
<th>Rank</th>
<th>TheraCal</th>
<th>Portland</th>
<th>Glass Ionomer</th>
<th>VLC Dycal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>2</td>
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<tr>
<td>1</td>
<td>1</td>
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<td>4</td>
<td>1</td>
<td>1</td>
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