The Evolution of Pediatric Clinical Practice

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T.A.N.S.T.A.A.F.L.
there ain't no such thing as
A free lunch!

Robert A. Heinlein
The Moon is a Harsh Mistress
His classic, Hugo Award-winning novel of libertarian revolution

An 1880 Western

Единая Россия

Chicago Cubs logo
Risk
Benefit
Ratio

The Benefit/Risk Ratio
A Handbook for the Rational Use of Potentially Hazardous Drugs

Editors:
Hans C. Korting
Monika Schäfer-Korting
Clinical applications with supportive research
“New Concepts for the Prevention of Dental Disease”

“a tide in the affairs of men which, when taken at the Flood, leads on to fortune”
- Shakespeare
Julius Caesar, Act 4, scene 3
“The day is surely coming and perhaps within the lifetime of you young men before me when preventive dentistry will replace reparative dentistry. When we will so understand the etiology and pathology of dental caries that we will be able to combat its destructive effects by systemic medication.”
Possible link between periodontal disease and coronary heart disease.

Matthews D.


Porphyromonas gingivalis hypercholesterolemia


Background: Periodontal diseases are chronic, inflammatory diseases that lead to destruction of periodontal tissues.

Methods: Porphyromonas gingivalis FDC bacterial samples were collected and colonization/infection assessed by PCR. Serum IgG antibody, one of the most commonly used indicators of periodontal disease, was also measured.

Results: Porphyromonas gingivalis was detected by PCR in nearly all mice throughout the experiment. Elevated IgG antibody compared to controls. Porphyromonas gingivalis increased maxillary bone when compared to control mice. Similarly, Porphyromonas gingivalis increased aortic plaque after BA in mice on normal diet on comparison to uninfected controls.

A specific increase in aortic plaque was also observed in the intimal and adventitial layers of the aorta (P<0.001 for both). This is the first study examining the effects of Porphyromonas gingivalis using mice exposed to periodontal disease (ABR) and plaque in non-injured mice but not in mice with angioplasty injury. Supported by University of Florida Opportunity Research Fund, R01DE015720-01, and U24 DE016509 from the NIH, NIDCR.
BIOFILM

A complex structure adhering to surfaces that are regularly in contact with water, consisting of colonies of bacteria and usually other microorganisms such as yeasts, fungi, and protozoa that secrete a mucilaginous protective coating in which they are encased. Biofilms can form on solid or liquid surfaces as well as on soft tissue in living organisms, and are typically resistant to conventional methods of disinfection. Dental plaque, the slimy coating that fouls pipes and tanks, and algal mats on bodies of water are examples of biofilms. While biofilms are generally pathogenic in the body, causing such diseases as cystic fibrosis and otitis media, they can be used beneficially in treating sewage, industrial waste, and contaminated soil.

We know that life, when you boil it right down, is a flow of electrons: "You eat sugars that have excess electrons, and you breathe in oxygen that willingly takes them." Our cells break down the sugars, and the electrons flow through them in a complex set of chemical reactions until they are passed on to electron-hungry oxygen.

In the process, cells make ATP, a molecule that acts as an energy storage unit for making the energy of living things safely available.

"That's how we get energy," says Nealson. "Our cells break down sugars and oxygen to make energy." The discovery of electric bacteria shows that some very basic forms of life can do away with sugary middlemen and handle the energy in its purest form – electrons, harvested from the surface of minerals. "It is truly foreign, you know," says Nealson. "In a sense, alien."
The CariScreen Caries Susceptibility Test is a quick, 1 minute chair-side test for ATP (adenosine tri-phosphate) levels on the teeth.

Keep swabs refrigerated until 5 minutes before use.

"There is no reason anyone would want a computer in their home."
Caries Risk Assessment

CariScreen Caries Susceptibility Test

The CariScreen Caries Susceptibility Test is a quick, 1-minute chair side test for ATP (adenosine triphosphate) levels on the teeth.

Keep swabs refrigerated until 5 minutes before use.

"There is no reason anyone would want a computer in their home."
Caries Risk Assessment
Interpreting the Results

Risk Indication Values (RLU’s)
- 0-1500 = low risk
- 1501-3500 = moderate risk
- 3501-9999 = high risk

“And in the end it's not the years in your life that count. It's the life in your years.”
Caries Risk Assessment
Interpreting the Results
• Chew paraffin gum
• Spit into collection vial and add reagents (1 drop Reagent 1 and 4 drops Reagent 2), mix
• Pipette up to third mark
• Place into well
• Wait for 15 minutes
• Check position of red line
• At T- over 500,000 cfu

But what about *Actinomyces viscosus*? *Apotobium* and *Propionibacterium*? *Lactobacilli*?
Evaluating Caries Risk CRT by Ivoclar

Which strain of SM?
Which species of Lactobacilli?
Trick Question

What is the difference between *Streptococcus mutans* and *mutans streptococci*?

*Streptococcus mutans* is a facultatively anaerobic, Gram-positive coccus-shaped bacterium commonly found in the human oral cavity and is a significant contributor to tooth decay. The microbe was first described by J. Kilian Clarke in 1924.
This is a pacifier which has been in a mouth and then incubated in a selective broth. Streptococcus mutans colonies are evident.

Transmission from Parent to Child

Genome sequence of Streptococcus mutans UA159, a cariogenic dental pathogen.
Department of Microbiology and Immunology, University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA.

Serotype classification of Streptococcus mutans and its detection on the oral cavity.
Nakano K, Ooshima T.

Protein antigen in serotype k Streptococcus mutans clinical isolates.

Generation of diversity in Streptococcus mutans genes demonstrated by MLST.
Infection Research Group, Dental Institute, University of London, London, UK.

Streptococcus mutans, consisting of serotypes c, e, f, and k, is an oral bacterial organism associated with the initiation and progression of dental caries. A total of 135 independent Streptococcus mutans strains from caries-free and caries-active subjects isolated from various geographical locations were examined in two versions of an MLST scheme consisting of either 6 housekeeping genes [accC (acyl-CoA carboxylase biotin carboxylase subunit), gki (glucokinase), lepA (GTP-binding protein), recP (transketolase), sodA (superoxide dismutase), and tyrS (tyrosine phosphatase)] or 7 housekeeping genes supplemented with 2 extracellular putative virulence genes [gtfB (glucosyltransferase B) and spaP (surface protein antigen)] for the 6 concatenated housekeeping genes alone. The number of nucleotide sequence types (STs) found varied between 20 (lepA) and 37 (spaP). Overall, 121 sequence types (STs) were defined using the housekeeping genes alone and 122 with all genes. However, nucleotide diversity per site, was low for all loci being in the range 0.019–0.007. The virulence genes exhibited the greatest nucleotide diversity and the recombination/mutation ratio was 0.67 (95% confidence interval 0.3–1.15) compared to 8.3 (95% confidence interval 5.0–14.5) for the 6 concatenated housekeeping genes alone. The ML trees generated for individual MLST loci were significantly incongruent and not significantly different from random trees. Analysis using ClonalFrame indicated that the majority of isolates were singletons and no evidence for a clonal structure or evidence to support serotype c strains as the ancestral S. mutans strain was apparent. There was also no evidence of a geographical distribution of individual isolates or that particular isolate clusters were associated with caries. The overall low sequence diversity suggests that S. mutans is a newly emerged species which has not accumulated large numbers of mutations but those that have occurred have been shuffled as a consequence of intra-species recombination generating genotypes which can be readily distinguished by sequence analysis.
Streptococci - Plaque Kingdoms

- Disease and colonization
- Adhesins
- Quorum sensing
- Competence
- Stimulating Peptide
If Parent is red complex positive, child is 35–54X more likely to be infected.

- Saliva is the major vector for transmission.
- Periodontal pathogens are communicable.

The Transmission of Anaerobic Periodontopathic Organisms

The Transmission of Periodontopathic Organisms Between Children and Caregivers
Y Lee et al  Pre-publication Data
Gary B. Huffnagle, Ph.D., is Professor of Internal Medicine, Microbiology, and Immunology, University of Michigan Medical Center. His research on probiotics has appeared in leading scientific journals and has been featured in Newsweek, Forbes, and on BBC News.

“A general belief is that microbes are harmful. This belief is erroneous. There are many useful microbes……”
Probiotics: “live microorganisms which when administered in adequate amounts confer a health benefit on the host.”


Pathogen = bacteria in the wrong place at the wrong time
Probiotic = bacteria in the right place at the right time
- Dr. Cannon’s Definition
“A post-antibiotic era — in which common infections and minor injuries can kill — far from being an apocalyptic fantasy, is instead a very real possibility for the 21st century.” (1)

-Dr. Keiji Fukuda, Assistant Director-General for Health Security, World Health Organization
\textit{L. reuteri} is indigenous to the human digestive tract, normal habitat in newborns as well as in adults (applies to only 3-4 Lactobacillus species). It should be a lifelong companion to us, while other lactobacilli are only temporary residents of the digestive tract, supplied through food and drink. 

How do probiotics work?

- Preventing the growth of pathogens
- Competitive displacement of pathogens
- Regulating gut microbial ecosystems
- Improving gut function/nutritional uptake
- Modulating immune responses to improve health


CONCLUSIONS. Bacterial translocation is a unique physiologic event, which is increased during pregnancy and lactation in rodents. Human breast milk cells contain a limited number of viable bacteria but a range of bacterial DNA signatures, as also found in maternal peripheral blood mononuclear cells. Those peripheral blood mononuclear cells showed greater biodiversity than did peripheral blood mononuclear cells from control women. Taken together, our results suggest that intestinally derived bacterial components are transported to the lactating breast within mononuclear cells. We speculate that this programs the neonatal immune system to recognize specific bacterial molecular patterns and to respond appropriately to pathogens and commensal organisms.
Treatment of the Mother Resulted in Less Disease in the Child

- Mothers chewed Xylitol gum for 2 years beginning at 3 mo post-partum.
- When the children were 5 years old, the need for treatment was 71-75% lower in the Xylitol group.
- Isokangas et al. JDR 2000

- Study group: 201 healthy, full-term infants aged four to ten months were studied at 14 child care centers for 21 months, covering two winter and two summer seasons.
*L. reuteri* effect on infections in infants attending child care.
L. reuteri inhibits intestinal pathogenic microorganisms

- Inhibition via reuterin, reutericyclin, organic acids, bacteriocins and other factors

- Bacteria examples:
  - Escherichia coli
  - Salmonella typhimurium
  - Listeria monocytogenes
  - Clostridium perfringens
  - Shigella spp.
  - Pseudomonas aeruginosa
  - Helicobacter pylori
  - Streptococcus mutans
  - Yersinia enterocolitica
  - Bacillus cereus
  - Staphylococcus aureus
  - Campylobacter jejuni

Lactobacilli in human and animal intestines

Species

<table>
<thead>
<tr>
<th>Human</th>
<th>Pig</th>
<th>Chicken</th>
<th>Cattle</th>
<th>Dog</th>
<th>Mice</th>
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<tbody>
<tr>
<td>L. acidophilus</td>
<td>Group</td>
<td>L. acidophilus (A-1)</td>
<td>b</td>
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<td>L. crispatus (A-2)</td>
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<tr>
<td>L. gallinarum</td>
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<td>L. gasseri (B-1)</td>
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<td>L. salivarius</td>
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<td>L. ruminis</td>
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<td>L. vitulinus</td>
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<td>L. hamsteri</td>
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<td>L. aviarius</td>
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<td>L. casei</td>
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<td>L. reuteri</td>
<td></td>
<td>L. brevis</td>
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</tr>
</tbody>
</table>

Symbols:

M  Major component of Lactobacillus species;
+  Occasionally recovered;
?  Questionable

**L. reuteri** inhibits oral pathogenic bacteria

- A. actinomycetemcomitans
- Fusobacterium nucleatum
- Porphyromonas gingivalis
- Prevotella intermedia
- Streptococcus mutans


"inimicus inimici mei amicus meus est"

"Computers in the future may weigh no more than 1.5 tons."
- Popular Mechanics, forecasting the relentless march of science, 1949.
Lactobacilli reuteri

- Probiotic chewing gum
- Probiotic drops
- Probiotic chewables

Tablets, straws 3 weeks

Cheese-reduced caries


Division of Nutrition, University of Helsinki, Helsinki, Finland.

Cheese is known to contain compounds that reduce the risk of dental caries. The long-term consumption of milk containing Lactobacillus rhamnosus GG, ATCC 53103 (LGG), has been shown to reduce caries risk in children. The aim of the present study was to examine whether short-term consumption of cheese containing LGG and Lactobacillus rhamnosus LC 705 would diminish caries-associated salivary microbial counts in young adults. Altogether, 74 18-35 year-old subjects completed this double-blinded, randomised, placebo-controlled study. During the 3 week intervention, the subjects ate 5 x 15 g cheese per day. Oral examinations were made before and after the study. Stimulated salivary secretion rates, buffer capacity and counts of salivary Streptococcus mutans, yeast and lactobacilli were evaluated before and after the intervention and after a 3 week post-treatment period. The results showed no statistically significant difference between the groups in Streptococcus mutans counts after the intervention, but during the post-treatment period there was a significantly greater reduction in these counts in the intervention group compared to the control group (P=0.05). However, Streptococcus mutans counts decreased in 20% (P=0.01) and yeast counts in 27% (P=0.005) of all the subjects, regardless of the intervention group. Results from logistic regression showed a trend indicating that probiotic intervention might reduce the risk of the highest level of Streptococcus mutans (OR=0.37, 95% CI 0.08-1.75, P=0.21) and salivary yeasts (OR=0.40, 0.09-1.71, P=0.22).
Probiotic therapy

BioGaia Probiotic lozenges

As BioGaia Probiotic chewing gum, BioGaia Probiotic lozenges contain L. reuteri, which has documented positive effects on your oral health. You let the lozenges dissolve slowly on your tongue. Just like BioGaia Probiotic chewing gum, they are sugar free and have a nice fresh mint flavor.

BioGaia Probiotic straw

Another innovative and fun way to get good Reuteri bacteria into your system is the probiotic straws. Each straw provides 100 million L.reuteri cells contained in an oil droplet which is released when you drink through it. BioGaia Probiotic Straws are for children, for the ill and the elderly, and are sold either separately or attached to drink packages.

10 days lozenge

A probiotic lozenge administered medical device and its effect on salivary mutans streptococci and lactobacilli

ESBER ÇAGLAR, OZGUR ONDER KUSCU, SULE KAVALOGLU CILDIR, SENEM SELUI KUVETLI & NUKET SANDALLI
Department of Paediatric Dentistry, Dental School, Yeditepe University, Istanbul, Turkey

Correspondence to: Dr Esber Çaglar, Department of Pediatric Dentistry, School of Dentistry, Yeditepe University, Bagdat cad 23B, Goztepe 34728 Istanbul, Turkey. Tel. +90 216 3636044/323; Fax: +90 216 3636211; E-mail: caglarer@yahoo.com

International Journal of Paediatric Dentistry 2008; 18: 35–39

Abstract

Background. Previous studies have suggested that lactobacilli-derived probiotics in dairy products may affect oral ecology, but the effects of different delivery methods have received little attention.

Aim. The aim of the present study was to investigate the effect of the probiotic Lactobacillus reuteri, delivered by a new medical device, on the levels of salivary mutans streptococci and lactobacilli in young women with high Streptococcus mutans counts.

Design. This is a randomized, double-blind, placebo-controlled study involving 20 healthy young women (aged 20 years): 10 as subjects and 10 as controls. The study subjects (Group A) sucked the medical device containing the probiotic lozenge with L. reuteri ATCC 55730/L. reuteri ATCC PTA 5289 (1.1 x 10^8 CFU) once daily for 10 days, while the control subjects (Group B) received placebo medical devices without bacteria. Salivary mutans streptococci and lactobacilli were enumerated with chair-side kits at baseline and 1 day after the final ingestion.

Results. Salivary S. mutans levels in the probiotic test group were significantly reduced, with statistical significance of reduction ($P < 0.05$).

Conclusions. A short-term daily ingestion of lactobacilli-derived probiotics delivered via medical device containing probiotic lozenge reduced the levels of salivary mutans.
- FDA approved in 2008
- Used in Europe for many years
- 1% chlorhexidine and 1% thymol varnish
Cervitec Plus- Ivoclar

- Swollen and inflamed gingival tissues
- Periodontal Classification Type I- gingivitis
Use of chlorhexidine varnish to prevent root caries may benefit some patients


David Leader, DMD, MPH

Systematic review conclusion. Chlorhexidine varnish (CHX-V) may be effective in preventing root caries in the absence of regular professional tooth cleaning and oral hygiene instructions for patients who need special care.

Critical summary assessment. A review of six randomized controlled trials demonstrates that CHX-V may benefit patients who require special care.

Evidence quality rating. Limited.

(which they assessed according to color and texture). The studies had, on average, a moderate estimated risk of bias. Meta-analysis of two studies that involved applications of CHX-V 1 percent and one study that involved CHX-V 10 percent...
Clinical Application of Probiotic Therapy

New adjunctive therapies offer new alternatives for treatment.

By Mark L. Cannon, DDS, MS
A study, published by Acta Odontologica Scandinavica, was performed by Professor Svante Twetman and his team in the Department of Cariology and Endodontics at the University of Copenhagen in Denmark. Commenting on the new study, Professor Twetman says "The importance of this study is not only that it supports earlier findings that L. reuteri Prodentis can be effective in the treatment of gingivitis, but also that it points towards an extended mechanism of action beyond the ability of fighting off pathogens. Our immune system involves mediators that promote inflammation when they are "turned on". Our results suggest that these mediators can be down-regulated by L. reuteri Prodentis."

In the study, 42 subjects with moderate gingivitis were randomly assigned to receive either chewing gum containing Lactobacillus reuteri Prodentis (either one or two chewing gums per day) or placebo (non-active) chewing gums during a two-week period. The number of bleeding sites was reduced in both groups taking Prodentis chewing gums, by 85% for those taking one Prodentis chewing gum per day and by 86% for those taking two. Both decreases were statistically significant. In the Prodentis groups, the amount of fluid in the teeth pockets was decreased by 43% for those taking one chewing gum per day and by 53% for those taking two chewing gums per day. Again the decrease was statistically significant in both Prodentis groups.

In the group that took two Prodentis chewing gums per day, Professor Twetman's group found a significant decrease of some important inflammatory mediators, TNF-ci and IL-8, which points towards a possible mechanism of action for Prodentis.
DNA-PCR and CRT Results in Children After Probiotic use

Methods

- 60 patients 6 to 12 years of age- caries prone with 4 or more restorations and /or lesions
- CRT collected before and after probiotic use
- 8 week (60 day) experimental time period- considered optimal to see effect
THE PRIMARY OBJECTIVE OF THIS CLINICAL STUDY IS TO DETERMINE THE EFFECT, IF ANY, OF “OVER THE COUNTER” PROBIOTIC SUPPLEMENTS ON THE DNA-PCR AND CRT ANALYSIS.
Frozen samples in CRT tubes
Kept at minus 80 degrees Celsius
Glycerol stabs of colonies for further analysis.
Current Research

Statistically significant differences between and within groups

PerioBalance and EvoraKids both affected the CRT results by reducing levels of S. mutans and Lactobacilli

### ANOVA Table

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>P-Value</th>
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<td>Between groups</td>
<td>84.3711</td>
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<td>Within groups</td>
<td>242.087</td>
<td>208</td>
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<tr>
<td>Total (Corr.)</td>
<td>326.458</td>
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</table>

The StatAdvisor

The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 10.3559, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 8 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.
DNA-PCR and CRT Results in Children After Probiotic use

Changes in SM before/after probiotic treatment

<table>
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<td>3</td>
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-4.0 -3.2 -2.4 -1.6 -0.8 0.0

Evora Perio Probiotic

sm_change MIDPOINT
DNA-PCR and CRT Results in Children After Probiotic use

Changes in Lacto before/after probiotic treatment

FREQUENCY

-3.0 -1.8 -0.6 0.6 1.8 3.0

<table>
<thead>
<tr>
<th>Evora</th>
<th>Perio</th>
<th>Probiotic</th>
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</table>
NOT enough evidence to indicate that EvoraPlus and PerioBalance changes the ‘SM’ or ”Lacto” measurements differently.
1. Selective agar complicated DNA extraction contaminating some samples.

2. *Streptococcus rattus* (included in EvoraPlus) was mis-identified as SM but is a mutans streptococci.

3. Other technical difficulties

The glucosyltransferase-I gene has previously been identified as a highly specific marker for *Streptococcus mutans* (Lett Appl Microbiol. 2006 Feb; 42(2):127-31). The primers and probe have 100% homology with all reference sequences for *Streptococcus mutans* in the NCBI database.
Conclusions:

A clinical trial to evaluate the effectiveness of DNA-PCR and CRT at measuring the salivary level of bacteria in caries prone children with PerioBalance or EvoraKids therapy.

Both EvoraKids and PerioBalance affected the CRT results. The reduction in S. mutans and Lactobacilli was statistically significant.
Conclusions:

Effectiveness of CRT at Measuring the Salivary Level of Bacteria in Caries Prone Children with Probiotic Therapy

Cannon M* / Trent B** / Vorachek A*** / Kramer S**** / Esterly R*****

**Aim:** This IRB approved clinical trial was to determine the effect of “over the counter” probiotic supplements on the Caries Risk Test- CRT (Ivoclar) results of the oral microflora in high caries risk children. **Study design:** Sixty subjects 6 to 12 years old with a caries risk assessment (CAMBRA) of moderate to high (caries prone) were evaluated by an analysis of the difference in the salivary levels of pathogenic bacteria (mutans streptococci and Lactobacilli). The subjects were randomly selected by randomizing software and assigned to two different Groups. Group A used PerioBalance (Lactobacillus reuteri-CFU of 200 million) lozenges for 28 days. Group B used the EvoraKids (Streptococcus uberis KJ2, Streptococcus oralis KJ3, Streptococcus rattus JH145, ≥ 100 million) probiotics chewable tablets for 30 days. Salivary samples were collected then incubated for 48 hours for colony counting and ranking. Follow up testing with the CRT was performed after 60 days at a follow up visit. **Results:** There was a statistically significant difference in the CRT results between the pre and post use of the probiotics. PerioBalance: SM results t = -6.78 p = .0001 Lactobacilli results t = -5.762, p < .0001, EvoraKids SM results t = -7.33, p < .0001, Lactobacilli results t = -2.952, p = .0068. **Conclusions:** The CRT values obtained with caries prone children may be significantly affected by probiotic use. Based on this study’s results the following conclusions can be made: Both EvoraKids and PerioBalance affected the CRT results by significantly decreasing the number of S. mutans and lactobacilli present in the saliva.
Retrospective Review of Probiotic Therapy.
ML Cannon DDS
MS
A Vorachek DDS
K White DMD
C Le DMD
An IRB Approved Study

Does EvoraKids and PerioBalance affected the caries proneness of the subjects?
Is the reduction in dental caries was statistically significant?
Retrospective Review of Probiotic Therapy.
ML Cannon DDS
MS A Vorachek DDS
K White DMD
C Le DMD
An IRB Approved Study

Materials and Methods:
Dental records of 60 patients that were enrolled in the Institutional Review Board approved study, "A clinical trial to evaluate the effectiveness of DNA-PCR and CRT at measuring the salivary level of bacteria in caries prone children with PerioBalance or EvoraKids Plus therapy" were reviewed as to current caries activity status with measurement of the Decay Missing Filled Teeth index and Caries By Risk Assessment (CAMBRA) determination. The current Oral health status was compared to the prior-to-study enrollment status and then analyzed in respect to published national norms.

Results:
Of the 53 subjects available for follow up, only 4 had remained caries active with a grand total of 17 caries lesions being detected and subsequently restored in this group. Of the original total of 60 patients with 292 initial carious lesions, after probiotic therapy and dental restoration, 36 total restorations were place in the subject group over the following three years. Approximately half of these restorations were required in teeth that had initially presented with smaller lesions and had been placed in a “watch” category. Two of the patients that developed further carious lesions had been randomly assigned to the probiotic PerioBalance, what the other two caries active patients were assigned EvoraKids probiotic.

Of the original group of caries active patients, 23 did not present with any further carious involvement. Another 26 could be categorized as Caries static, as the restorations required were substantially less than before probiotic therapy had been begun.
Retrospective Review of Probiotic Therapy.

ML Cannon DDS
MS A Vorachek DDS
K White DMD
C Le DMD

An IRB Approved Study

Conclusion:
Within the limitations of this retrospective IRB approved study, the tested probiotic supplements had a statistically significant effect on the caries experience of the enrolled subjects.

Table 1. Caries active, Caries resistant and Caries static patients.

<table>
<thead>
<tr>
<th>Caries Experience</th>
<th>Pre Probiotic</th>
<th>National Average</th>
<th>Post Probiotic</th>
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<tbody>
<tr>
<td>Per patient-3 years</td>
<td>5.51</td>
<td>1.84</td>
<td>0.75</td>
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Table 3. Caries History Compared to Nationally Reported Values.

<table>
<thead>
<tr>
<th>Caries Experience</th>
<th>Pre Probiotic</th>
<th>National Average</th>
<th>Post Probiotic</th>
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<tbody>
<tr>
<td>PerioBalance</td>
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<td>15</td>
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<tr>
<td>EvoraKids</td>
<td>2</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Caries Count</td>
<td>17</td>
<td>0</td>
<td>36</td>
</tr>
</tbody>
</table>

Table 1. Caries active, Caries resistant and Caries static patients.
Lactobacillus-mediated interference of mutans streptococci in caries-free vs. caries-active subjects.

Final pH affects the interference.

SELECTION OF MUTANS

Location: Exhibit Hall D (Walter E. Washington Convention Center)

E. PALMER, T. FINLAYSON, T. MAIER, and C. MACHIDA, Great Lakes Orthodontic Research Foundation

Objectives: Dental caries are a major public health concern in children. Mutans streptococci are genetically defined and assessed for their ability to interfere with the mutans group. The present study investigated the effects of the 12-hour period of under-salivaation on the caries-protective properties of selected mutants.

Methods: Using arbitrarily-purified mutans from the oral cavity of healthy volunteers, the under-salivaation of mutans was performed for 12 hours. The pH of the under-salivaation was monitored and the results were compared with the pH of the saliva before and after the under-salivaation.

Results: Inter-patient variability was reduced by 50% after 12 hours of under-salivaation, and the pH of under-salivaation increased from 14% to 78% of the pH of the saliva before and after the under-salivaation.

Conclusions: Caries preventive practices may be improved by the development of well-accepted practices for caries protection. The present study suggests that under-salivaation may be a useful tool for reducing the risk of dental caries.
BASF set to commercialize pro-t-action™ eliminating caries causing bacteria from the mouth
The active ingredient in ProAct™, L. paracasei, is a natural active ingredient with a specific and selective mode of action. During production only selected natural ingredients, trace elements, salts and natural ProAct™ microorganisms are used. The microorganisms are fermented, and stabilized, pasteurized and dried after harvesting. Like with all BASF products, comprehensive safety and toxicological testing have been conducted in full.
Xylitol- Cancun Conference 2013
Xylitol- 5 carbon chain

Xylitol (wood alcohol). Xylitol is found in the fibers of many fruits and vegetables, and can be extracted from oats, and mushrooms, as well as fibrous material such as corn husks and sugar cane bagasse.
Xylitol- from xylose

• Production starts from xylan (a hemicellulose) extracted from cane, hardwoods or corncobs, which is hydrolyzed into xylose and catalytically hydrogenated into xylitol.
Xylitol chewing gums and caries rates: a 40-month cohort study.
Mäkinen KK, Bennett CA, Hujol PP, Isokangas P I, Isotupa KP, Pane HR, Ir Mäkinen PI.

% Remineralisation

- Sucrose
- No gum
- 100% sorbitol
- 100% xylitol

0.27; 95% confidence interval, 0.20 to 0.36; p = 0.0001). This gum was superior to any other gum effective than xylitol, but they reduced caries rates significantly compared with the no-gum controls. The results suggest that systematic usage of polyol-based chewing gums is being more effective than sorbitol gums.
Xylitol- research


Polyol chewing gums and caries rates in primary dentition: a 24-month cohort study.
Mäkinen KK, Huijel PP, Bennett CA, Isotupa KP, Mäkinen PL, Allen P
Department of Biologic and Materials Sciences, School of Dentistry, University of Michigan, Ann Arbor, USA.

Abstract
The effect of 2-year chewing-gum use on the caries rates of primary teeth was studied in a combined school and home program in a sample of 510 initially 6-year-old subjects with high caries experience, low availability of fluoride, and difficult access to dental care. The gum, formed into either sticks or pellets, comprised either xylitol, sorbitol, or mixtures thereof. The gum was chewed for 5 min under supervision five times a day during the school year, and for variable times during non-school days. Seven groups were studied. One group received no gum; two xylitol gum groups received either pellet or stick gum; a 2:1 stick pellets gum group; and three sorbitol gum groups. The response variable was the development of caries lesions detected by a clinical light of the tooth. All groups were followed throughout those surfaces of primary teeth that were not cavitated at baseline. Caries rates associated with the use of each of the gum types were compared to the caries rates in the no-gum group. The usage of all polyol gums resulted in a significant decrease of the caries onset rate (p < 0.05). The caries onset risk for a primary surface in the xylitol pellet and the sorbitol pellet groups was 35 and 44% of that in the no-gum group (relative risk, 0.35; 95% confidence interval, 0.21-0.59; relative risk, 0.44; 95% confidence interval, 0.30-0.63, respectively). The caries onset risk in the xylitol stick gum group was 53% of that in the no-gum group (relative risk, 0.53; 95% confidence interval, 0.39-0.72), which was marginally (p = 0.1520) lower than in the sorbitol stick gum group (relative risk, 0.70; 95% confidence interval, 0.52-0.94). The usage of both xylitol/sorbitol mixtures in pellet form was associated with a caries onset rate comparable with the usage of the xylitol stick gum. The largest caries risk reduction was observed in the group receiving xylitol pellet gum.
Influence of maternal xylitol consumption on acquisition of mutans streptococci by infants.

Söderling E, Isokangas P, Pienihäkkinen K, Tenovuo J.
Institute of Dentistry, University of Turku, Finland. eva.soderling@utu.fi

Abstract

Xylitol is effective as a non-cariogenic sugar substitute. Habitual xylitol consumption appears to select for mutans streptococci (MS) with impaired adhesion properties, i.e., they shed easily to saliva from plaque. One hundred sixty-nine mother-child pairs participated in a two-year study exploring whether the mothers' xylitol consumption could be used to prevent mother-child transmission of mutans streptococci. All mothers showed high salivary levels of mutans streptococci during pregnancy. The mothers in the xylitol group (n = 106) were requested to chew xylitol-sweetened gum (65% w/w) at least 2 or 3 times a day, starting three months after delivery. In the two control groups, the mothers received either chlorhexidine (n = 30) or fluoride (n = 39) mouth rinse twice daily. MS were assessed in the infants' saliva and in the mother's plaque at a six-month and two-year examination. Salivary MS were cultured on Mitis salivarius agars containing bacitracin. The salivary MS levels of the mothers remained high and not significantly different among the three study groups throughout the study. At two years of age, 9.7% of the children in the xylitol, 29.6% in the chlorhexidine, and 48.5% in the fluoride varnish group showed a detectable level of MS. In conclusion, there was actually a reduction in MS after xylitol consumption by mothers was associated with a statistically significant reduction of the probability of mother-child transmission of MS at less than two years of age. The effect was superior to that obtained with either chlorhexidine or fluoride varnish treatments performed as single applications at six-month intervals.

Söderling E, Hirvonen A, Karjalainen S, Fontana M, Catt D, Seppä L.
Adjunct Professor, Institute of Dentistry, University of Turku, Finland. eva.soderling@utu.fi

Abstract

OBJECTIVES: Our aim was to investigate the effect of short-term xylitol consumption on the microbial composition of plaque and saliva.

METHODS: Twelve volunteers (22-38 yrs) harboring mutans streptococci (MS) participated in the randomized, double-blind, cross-over study. The experimental chewing gum contained 65% xylitol while the control gum contained 63% sorbitol and 2% maltitol w/w. The polyol dose was approximately 6 g/day. Stimulated saliva and plaque samples were collected before and after the two four-week test periods. The samples were cultured for MS, total streptococci, lactobacilli, and total facultatives. A part of the samples were subjected to DNA-DNA hybridizations of 14 microbial plaque species: Actinomyces naeslundii, A. viscosus, Fusobacterium nucleatum, Lactobacillus acidophilus, L. fermentum, L. paracasei, L. rhamnose, L. plantarum, Streptococcus gordonii, S. oralis, S. parasanguis, S. salivarius, S. sanguinis, Veillonella parvula.

RESULTS: The MS counts of the plaque samples collected from “caries-prone” tooth sites decreased significantly (P<.01) in the xylitol gum group but not in the sorbitol gum group. Also the plaque MS percentage decreased significantly in the xylitol gum group (P<.01). The salivary MS counts did not decrease either in the xylitol or in the sorbitol gum groups. Nor were changes detected in the salivary levels of total streptococci or lactobacilli. The DNA-DNA hybridization assay revealed no study-induced changes in the microbial composition of the dental plaque.

CONCLUSIONS: Within the limitations of this pilot study, xylitol consumption reduced MS counts in plaque but appeared not to affect the microbial composition of plaque or saliva in general.
Salivary mutans streptococci and dental caries in three-year-old children after maternal exposure to chewing gums containing combinations of xylitol, sorbitol, chlorhexidine, and fluoride.

Thorild I, Lindau B, Twetman S.
Public Dental Clinic, Varberg, Sweden.

How Risk kids? mg levels

Ris Proper Diagnosis TANSTAAFL
Carriogenic traits in xylitol-resistant and xylitol-sensitive mutans streptococci.

Aasey S, Stig S, Scheie AA.

Department of Oral Pathology, Institute of Stomatology, University of Oslo, Norway.

Abstract

Long-term xylitol consumption leads to the emergence of carriogenic traits in X-R and xylitol-sensitive (X-S) strains. Resistance and sensitivity were confirmed by growth rate and enzyme assays initiated by adding (14)C-labelled glucose, fructose, and sucrose, the major metabolite from glucose, whether the bacterial unit was lower in X-S cells than in X-R cells. Fructokinase activity (EC 2.7.1.1) in xylitol-5-P was detected in X-S cells only. Total polysaccharide content of [U(14)-C]-sucrose. No difference in polysaccharide content of X-R are less carriogenic than X-S in
Xylitol- sugar substitute

• The roles of xylitol in maintaining dental health:
  • Inhibits the growth of cariogenic bacteria
  • Inhibits the formation of dental caries
  • Inhibits the growth of plaque
  • Suppresses the acidity of plaque
  • Accelerates enamel re-mineralization
  • Is not an ideal substrate for bacterial growth because of its difficult-to-ferment nature
Xylitol - sugar substitute

- Low glycemic index - safe for diabetics
- Reduces sinus and ear infections
Dr. Alonzo H. Jones, D.O., a family physician in west Texas, now retired, was trying to find a solution for the people coming to see him for upper respiratory issues. He studied the research pointing to the benefits of xylitol for improving oral health and its effects on bacteria. He noted that upper respiratory problems had been steadily increasing since the early 1970s, owing to environmental factors that included poorly conceived drug therapy and growing antibiotic resistance. 

Xylitol products

• Xclear (Clear)
• Established 2000 to launch the company’s first commercially available product, Xclear® Nasal Spray.
Xylitol products

- Xlear (Clear)
MRE- xylitol gum- G.I. issue

Not the tastiest food
Preventive Care

• Going too far!

Invasive dentistry “bites”
Pediatric Protocols
New Concepts in Preventive Care

Susan Hagen RDH
Lisa Lange- DA
Megan Weirich- DA
Associated Dental Specialists of Long Grove
Grove Medical Center, Long Grove, IL USA
Protocols

Standardize Care
Minimizes Mistakes
Increase Efficiency

Education

Practitioner
Staff
Patients and Parents
How things have changed!!!
Re-educate, that is the key.
How things have changed!!!

Re-educate, that is the key.
Pediatric Dental Care Protocols

- Defined by:
  - Age
  - Exam
  - Diagnostic tests
  - Behavior
  - Medical/Dental history

Infant Examination
All infants to three years of age. Detailed medical history obtained prior to appointment. Maternal/child dental history obtained.

Parental questions and concerns are extremely important and must be considered at the beginning of each appointment.

Child exam and prophylaxis as able with MI fluoride varnish application.
Inform and encourage the use of xylitol products for child and caregiver.
Pediatric Dental Care Protocols

- Treatment determined by Diagnosis and History
- Educate parent
- Parent education

Give positive advice on diet, decay prevention, bottle use, and sucking habits. Tooth brushing instructions given to parent/child. Explain Importance of establishing dental home in case of trauma. Regular recare visits stressed.

*Preventive products given as needed—xylitol products, toothpaste, MIPaste, probiotic drops*

Maternal intervention
CAMBRA

- Patient treated as an individual and according to need

Caries Management By Risk Assessment

The Caries Imbalance

Protective Factors for Remineralization
- Saliva components and flow
- Fluoride, calcium, phosphate
- Antibacterial agents

Pathological Factors
- Cariogenic bacteria
- Fermentable carbohydrates
- Salivary dysfunction

Disease Indicators in Demineralization
- White spots
- Restorations <3 yrs old
- Enamel lesions
- Cavities/dentin

NO CARIES

Featherstone, Young, Woulf, 2007
 Pediatric Dental Care Protocols

• New Patient and Recare Evaluations

New Patient/Recare Examination Appointment
All new patients require an extensive evaluation and consultation. Whenever possible, new patients with known medical/dental issues should be scheduled on the doctor’s schedule to increase patient contact time, especially in preventive care.

Treatment coordinators should be available to present future restorative appointments plus provide insurance estimates. E-mails MUST be obtained to allow for E-Reports.

Use New Technology

Patient Evaluation
RESULTS: Attentional deficits have been reported in up to 95% of OSA patients. In full syndromal ADHD, a high incidence (20% to 30%) of OSA has been shown. All 6 interventional studies reported improvements in behavior, inattention, and overall ADHD after treatment of OSA.

Is obstructive sleep apnea associated with ADHD?

Nagy A. Youssef, MD
Margaret Ege, MD
Sohair S. Angly, MD
Jennifer L. Strauss, PhD
Christine E. Marx, MD, MA

BACKGROUND: It has been suggested that obstructive sleep apnea (OSA) may result in symptoms similar to those experienced in attention-deficit/hyperactivity disorder (ADHD). Because this may have important public health implications, we reviewed the literature regarding this association, with a focus on interventional studies examining the effect of OSA treatment on change in ADHD symptoms.
Pediatric Dental Care Protocols

- Facial exam
  - Do they look and function normally?
  - Allergies
- Morgan Dennie Lines and venous pooling
- OSA - obstructive sleep apnea
- Parental history
Obstructive Sleep

Sleep Medicine Center

The Sleep Medicine Center at Lurie Children’s is the only comprehensive sleep center in Illinois dedicated solely to children. The center provides clinical evaluation, diagnosis and management of children with all forms of sleep disorders. Sleep disorders treated by our staff include sleep-disordered breathing, sleep apnea, nightmares, insomnia, parasomnias, narcolepsy and circadian rhythm disorders. Since its opening in 1995, the sleep specialists have seen more than 5,000 patients, and more than 14,000 patient studies have been conducted.

Our Specialists

The center is directed by Stephen H. Sheldon, DO. Dr. Sheldon is board-certified in both pediatrics and sleep disorders medicine. He has served as a member of the board of directors and was Secretary/Treasurer of the American Academy of Sleep Medicine. He has been a faculty member of the National Sleep Medicine Course (sponsored by the AASM) and is course director of the Advanced Pediatric Sleep Medicine Program of the Atlanta School of Sleep Medicine, Northside Hospital, Atlanta, Georgia.

Darius A. Loghmanee, MD, board-certified in internal medicine, pediatrics and sleep disorders medicine. Since 2008, Dr. Loghmanee has treated patients at Lurie Children’s with sleep-disordered breathing, insomnia, parasomnias, narcolepsy, circadian rhythm disorders and other conditions in the spectrum of sleep disorders.

Pediatric Dental Care Protocols

• Pre-operative view of four year old male with anterior and posterior crossbites
• Maxillary hypoplasia
Pediatric Dental Care Protocols

- Wilson Quadhelix for maxillary arch development
- Expand both anterior and posterior segments
Pediatric Dental Care Protocols

• Post operative view with upper arch expansion evident
• Note molar bands and no snoring/sleep issues
Four year old girl with anterior crossbite and prognathic profile

Patient bites edge to edge and slides anteriorly

Parents concerned about profile

No family history of Class III relationships

OSA!! Sleep Study
Pediatric Dental Care Protocols

- Frontal view in full occlusion - pre-operative photo
- Sleep apnea reported - snoring/ sleep issues
- Wilson Quadhelix cemented and crossbite corrected
• Child no longer appears prognathic and crossbite corrected, mother quite happy no snoring/OSA
Anterior crossbite with retrognathic profile
Treated with Wilson Quadhelix appliance
Snoring with sleep apnea episodes- ENT “normal”
Pediatric Dental Care Protocols

- Anterior crossbite corrected
- Molars bands left on for one year post treatment
- Arch form restored to normal
- No snoring!!
Pediatric Dental Care Protocols

- Cariscreen from Oral Biotech

**Cariscreen** - sample of plaque swabbed from two teeth of patient. Parents are instructed prior to appointment regarding food and drink restriction or brushing within an hour previous to testing. They should not be taking antibiotics for the test to be accurate. The test takes the least time, very reliable. **60** seconds to equilibrate, **15** seconds to run plaque sample.
Saliva check mutans - sample of saliva collected by chewing wax, specific only for *Streptococcus mutans*, uses antibody/antigen specificity, not as universal as it does not test for all pathogens, 15-20 minutes for test and results.
Pediatric Dental Care Protocols

• Caries Risk Test (CRT)

Diagnodent Caries Risk Test—uses samples of saliva and/or plaque, tests for mutans streptococci and lactobacilli. Not specific at all, often reflects growth of probiotic bacteria but has the most research and longest clinical use. Saliva sample obtained by chewing wax, then medium is incubated for 48 hours.

Diagnodent—Patients with deep pits, stains, history of pit and fissure decay, bruxism, or suspicious radiographic results, can confirm x-ray findings, or for patients where x-rays cannot be taken such as small children, strong gag reflex patients, special needs. Readings of 0-25, normal, 25-35 remineralize or high fluoride use, reading over 35, restore. With readings documented, can monitor at future recare visits. Uses weak laser beam.
Pediatric Dental Care Protocols

PREVENTIVE CARE PROTOCOLS

Infant – First Visit at Age One

BioGaia probiotic drops depending on history.

MI Paste for enamel defects, MIH.

Explain relationship between enamel defects and aphthous ulcers and celiac disease.

Use xylitol, non-fluoride toothpaste and safe toothbrush. Xylitol wipes if no or a few teeth present. Xylitol gel and pacifier.

Parent cleaning child’s teeth twice daily, water only in bottle at nap time or bed time.
GC Saliva Check!

Quality/Quantity & Buffering Matters!
Are good saliva test results just as meaningful as bad results?
Pediatric Dental Care Protocols

- Preventive Care Protocols

**Dry Mouth (Xerostomia):**
- GC Dry Mouth Gel
- Biotene
- OraMoist
- Oasis
- Xylitol patch
- Rain Advanced Oral Moisturizer

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**Image:**
- Examples of dry mouth products.
Dental Products: Brushes and Flossies

• Soft bristle toothbrushes with rounded head and easy grips are best for Little patients - easier to manipulate
Some will tolerate flossing well by using floss holders, such as, “Flossies”.

Floss holders with large handles are easier to use.

Care must be taken not to “saw” back and forth with the floss.
Pediatric Dental Care Protocols

• Preventive Care Protocols

Maternal
Discuss with mother xylitol gum or mint use and why, encourage use.
Give copy of maternal use of xylitol/child protection from decay research article. Ask mother to share with pediatrician.
Explain probiotic use to mother, give information on Klaire Lab products, and oral probiotics, such as Evora Plus and PerioBalance.
Twice yearly dental visits stressed for themselves and good home care practices.
**Pediatric Dental Care Protocols**

- **Teen and Young Adult Oral Hygiene Regimen**
  - Regular fluoride toothpaste, sweetened with xylitol preferred.
  - PerioBiotic or Spry Xylitol with Fluoride toothpaste if gingival inflammation present or full orthodontic care.
  - PerioBalance oral probiotic for gingival health.
  - Prevident or Clinipro 5000 for interproximal lesions starting with no decalcification present.
  - MIPaste Plus if decalcification is present or sensitivity during bleaching.
  - MI Fluoride varnish if enamel defects or decalcification present, or Cervitec varnish if fiery red gingival tissue.
  - Laser Bacterial Reduction or Fotosan and Prolacsan therapy.