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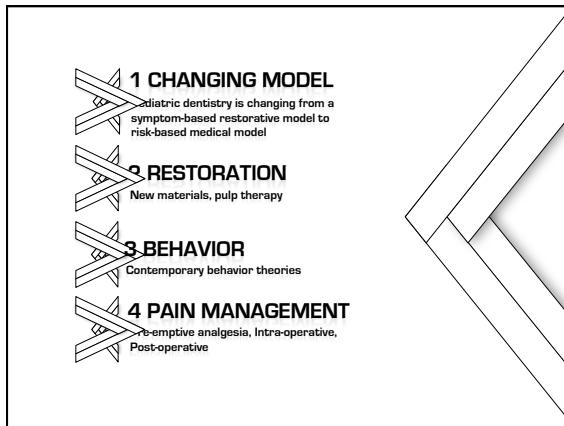


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Associate Professor and Program Director, Pediatric Dentistry



## Objectives

- Propose behavior guidance techniques for clinical examples
- Identify approaches to prevent and manage the microbial aspects of dental caries
- Apply evidence to predict the survival rate of different restorative materials
- Describe indications for vital and non-vital pulp therapy in primary teeth
- Explain some of the errors that can lead to under-treatment of pain in children



**1 CHANGING MODEL**  
Pediatric dentistry is changing from a symptom-based restorative model to a risk-based medical model

**2 RESTORATION**  
New materials, pulp therapy

**3 BEHAVIOR**  
Contemporary behavior theories

**4 PAIN MANAGEMENT**  
Pre-emptive analgesia, Intra-operative, Post-operative

## Emerging Paradigm

- "Although dental repair restores function and esthetics, it **does not arrest disease progression** because it does not affect underlying determinants of this chronic disease."
  - Edelstein et al, JADA 2015
- ADA's Response to Dental Therapists (2012):
  - The nation will never drill, fill and extract its way out of what amounts to a public health crisis among some populations. Throwing more "treaters" into the mix amounts to digging a hole in an ocean of disease. Instead, what is required is a fundamental shift in oral health from a model of surgical intervention to one of disease prevention, because virtually all dental disease is preventable.

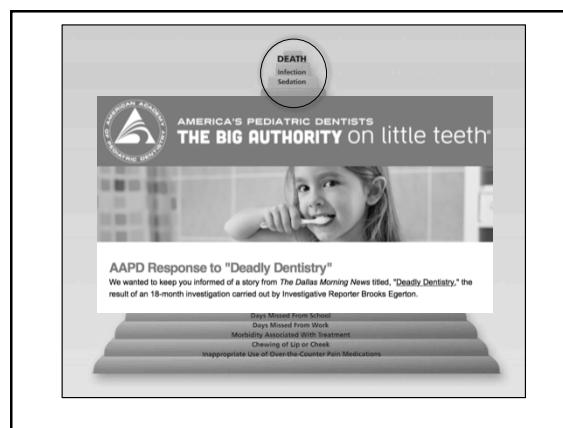
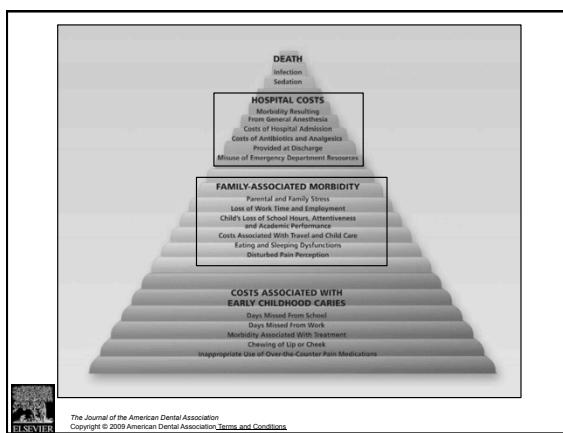
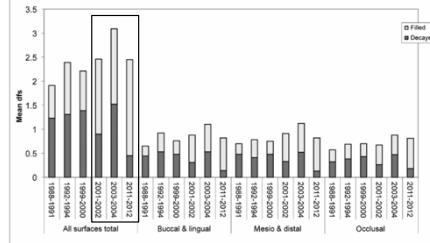


## The “Silent Epidemic”

- unmet healthcare need
  - Over 20% of children have untreated caries
- 4.5 million children develop the disease annually
- More than half of children aged 5-9 have had at least one cavity or filling
- By age 11, over 40% of children have had caries (this is roughly 30 million children) and this increases to 78 percent by age 17
- By age 19 approximately 10% have lost at least one permanent tooth to caries.

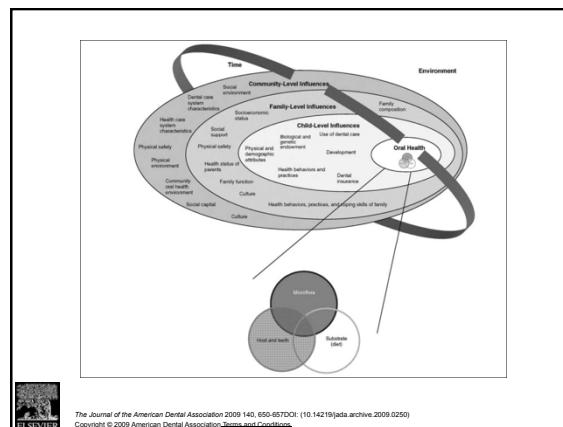
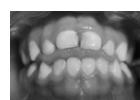
## Latest US Data

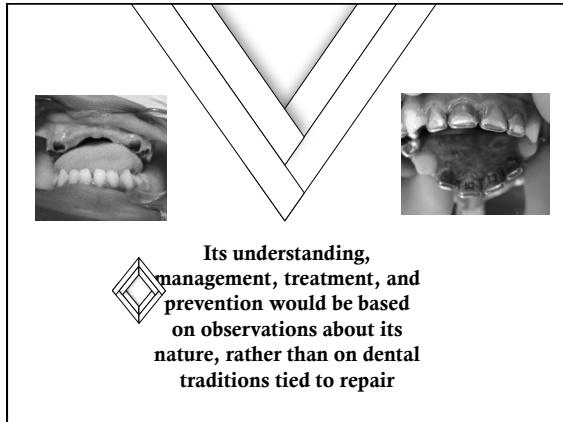
Figure 2. Decayed and filled primary dental services (dfs)\* for children age 2-5 years by surface group: United States, 1988-2012.



## The Nature of ECC

- Caries is a *disease* and is *infectious*
  - Cariogenic bacteria are *transmissible* within families when children are infants or toddlers
- Caries is *diet dependent*
- Caries is *fluoride mediated*
- Caries is *progressive and destructive* but *reversible*
- Caries is *highly prevalent among toddlers*
- Caries is *consequential to children's & families' lives*
- Caries is *inequitably distributed*
- Caries is *little affected by dental repair*





## How Things Would Be Different

### New Paradigm

First visit age:  
prenatal, then 3-6 months

Prevention:  
limit transmission (primary)

Primary therapy:  
disease management

Interventions: risk-based

### Old Paradigm

First visit age:  
3 years or symptoms

Prevention:  
hygiene, diet, fluoride  
(secondary)

Primary therapy: restorations

Interventions: symptoms-based

**Patient Information**

Pregnant woman/child's name \_\_\_\_\_ Date of birth \_\_\_\_\_ Phone number \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip code \_\_\_\_\_

This practice is the pregnant woman/child's dental home:  Yes  No

**Current Oral Health Status**

Does the pregnant woman or child have any teeth with untreated decay?  Yes  No (decay)  No (decay-free)

Does the pregnant woman or child have any teeth that have previously been treated for decay, including fillings, crowns, or dentures?  Yes  No (decay-free)

Does the pregnant woman have gum disease?  Yes  No

Are there treatment needs?  Yes, urgent  Yes, not urgent  No treatment needs

**Oral Health Care Services Delivered**

**Diagnostic/Preventive Services**

Examination:  Yes  No  No

Cleaning:  Yes  No  No

Fluoride varnish:  Yes  No  No

Dental sealants:  Yes  No  No

**Counseling/Motivational Guidance**

Referrals to Specialty Care:  Yes  No  No

**Restorative/Emergency Care**

Filings:  Yes  No  No

Crowns:  Yes  No  No

Extractions:  Yes  No  No

Emergency care:  Yes  No  No

Other:  Yes  No  No

(Please specify specialty)

ORIGINAL CONTRIBUTIONS

**Perspectives on evolving dental care payment and delivery models**

Mervin S. Holden, DDS, MS, MPH, Burton L. Johnson, DDS, MS, MPH

**ABSTRACT**

**Background:** Health care reform is well under way in the United States, and dental care is no exception. The changing delivery system and payment approaches are affecting medicine almost as much as dentistry.

**Objectives:** The purpose of this article is to examine how the dental care delivery system has changed over time, describe some of the challenges and opportunities that have arisen, and propose alternative models to characterize the relationship between the dental care delivery system and payment system.

**Design:** This article is a review of the literature on the evolution of medical payment approaches, including those tied to performance measures, and the impact of these changes on dental providers.

**Results:** Advances in understanding the essential role of dental health care in overall health care have led to broader discussion of care integration and patient safety. The dental care delivery system has changed over time to reflect a variety of forces. Common provider payment approaches include fee-for-service, capitation, and salary—set tied inextricably to performance when possible.

**Conclusion:** The dental care delivery system and payment approaches will continue to change as the dental profession explores alternative models to improve the quality of dental care and reduce costs. The dental care delivery system and payment approaches will continue to change as the dental profession explores alternative models to improve the quality of dental care and reduce costs.

**Keywords:** financing, delivery of health care, health care delivery, dental care, dental delivery, dental payment, dental insurance

JADA 2010;141(1):36–34. © 2010 American Dental Association. All rights reserved.

## Dental Home

- The ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way
- Should be established no later than 12 months of age
- Modeled after the medical community because it is more effective and less costly than ER care

## The knee to knee exam

First visit: What to do?  
Caries Risk Assessment  
Anticipatory Guidance (trauma prevention, tooth eruption)  
Address parental concerns  
Discuss diet, OH, finger/pacifier habits, what toothpaste to use, etc..

Use a regular straight-backed chair with no arm rests for Mom. Child sits facing Mom, child's legs are around Mom, Mom is holding hands, child lays back with head in dentist's lap

Pre-Operative Risk Assessment	Pre-Operative Treatment	Dental Visit	Optimal Interventions		Interventions		Interventions		Interventions		Intervention® Coding section
			Initial Visit	Follow-up Visit	Initial Visit	Follow-up Visit	Initial Visit	Follow-up Visit	Initial Visit	Follow-up Visit	
Low	Annual		Primary prevention at 12-month intervals if no caries or periodontal disease and with a low risk of caries or periodontal disease. Home fluoride by the highest safe amount of Cariostatic Fluoride.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	N/A
Highest	Every 6 months	Suggested	Primary prevention at 6-month intervals if no caries or periodontal disease and with a moderate risk of caries or periodontal disease. Home fluoride by the highest safe amount of Cariostatic Fluoride.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	Treat fluoride products as indicated
Moderately increased	Every 9 months	Recommended	Primary prevention at 6-month intervals if no caries or periodontal disease and with a moderate risk of caries or periodontal disease.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	Treat fluoride products as indicated
High	Every 3 months	Recommended	Primary prevention that includes fluoride varnish and/or topical fluoride application every 3 months. Home fluoride by the highest safe amount of Cariostatic Fluoride.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	CDE (carious tooth preparation, debridement, and fluoride)
Highly increased	Every 1-2 months	Recommended	Primary prevention that includes fluoride varnish and/or topical fluoride application every 1-2 months. Home fluoride by the highest safe amount of Cariostatic Fluoride.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	CDE (carious tooth preparation, debridement, and fluoride)
Extreme	Every 1-2 months	Recommended	Primary prevention that includes fluoride varnish and/or topical fluoride application every 1-2 months. Home fluoride by the highest safe amount of Cariostatic Fluoride.	Intrafluoride Sealants	No	Optimized sealant placement of all primary teeth and all secondary molars. Optimal placement of all primary teeth and all secondary molars.	No	Not Required	No	No	CDE (carious tooth preparation, debridement, and fluoride)

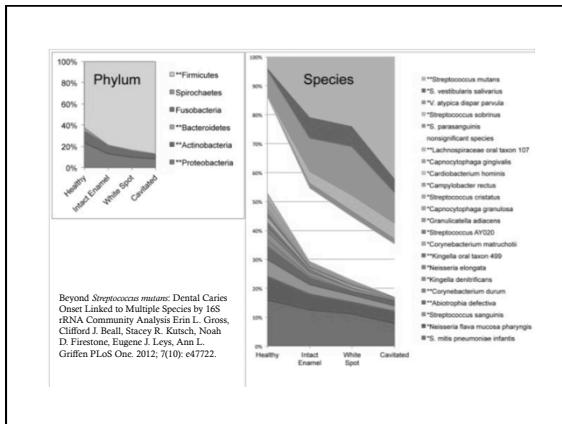
## What We Already Know Helps Reduce ECC?

- Brushing with fluoridated toothpaste
  - Fluoride varnish
  - Sealants in permanent teeth
  - Restoration?
    - Research consistently indicates a relapse rate in the range of 22-79%
    - HOWEVER, research shows significant improvement in quality of life after restoration



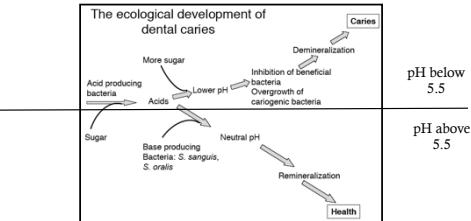
## Other Ideas?

- Xylitol
    - Disclaimer: Studies Inconclusive
    - May help reduce transmission from mother to infant
    - May reduce caries in children
    - Problem: may not be realistic clinically → large doses 4-5 times a day
  - Glass ionomer sealants
    - Not well retained; may not reduce caries overall
  - Chlorhexidine
    - Only a short-term intervention
  - Probiotic bacteria
  - Arginine containing toothpastes/candies



## Ecological Plaque Hypothesis:

- Disease results from shifts in the balance of the resident plaque microflora. Potentially cariogenic bacteria can be present in health, but at levels that are not clinically relevant. Disease could be controlled not only by targeting putative pathogens but also by interfering with the factors responsible for driving the deleterious shifts in the microflora. \*Marsh, 1994.



## Novel Pro-arginine System

- Arginine bicarbonate calcium carbonate complex
- Basicbites® with Cavistat®: [www.basicbites.com](http://www.basicbites.com)
  - Acevedo et al. Clinical evaluation of the ability of CaviStat in a mint confection to inhibit the development of dental caries in children. *J Clin Dent.* 2008;19(1):1-8.
  - Over a 50% reduction in caries; helped arrest incipient caries
  - Rx: 2 after breakfast and one at bedtime
- Toothpaste with arginine, insoluble calcium, +/- fluoride
  - Reduces caries more than fluoride toothpaste alone
  - Acevedo et al, 2005; Kraivaphan et al, 2013; Souza et al, 2013; Li et al, 2015

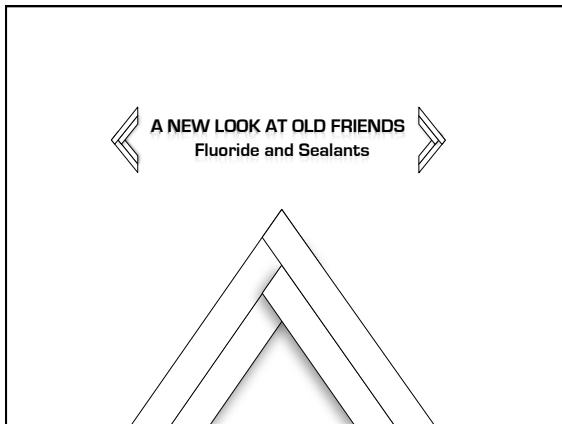


## CariFree® System

- Carifree.com (not advocating these products – just showing this as an example of the new model of caries management)
- Developed off the work of Featherstone and colleagues who basically say that we need to establish the patient's risk level (ie. Caries Risk Assessment) and provide targeted interventions
  - CariScreen (microbiologic testing)
  - Products (gels, varnish, xylitol, mineralizing agents)

CARIES MANAGEMENT GUIDE				
LOW RISK	MODERATE RISK	HIGH RISK	HIGH RISK	HIGH/EXTREME RISK
No Risk Factors No High Risk Challenges	No Risk Factors No High Risk Challenges	High Risk Factors Low Risk Challenges	High Risk Factors High Risk Challenges	High Risk Factors High Risk Challenges
CT10 KR Cavity Free	CT20 KR Cavity Free	CT21 KR Cavity Free	CT22 KR Cavity Free	CT30 KR Cavity Free
1-2 times a month	2-3 times a month	3-4 times a month	4-5 times a month	5-6 times a month

RECOMMENDED THERAPY				
Therapy for No Risk Factors / Low Risk Challenges				
CT10 KR Cavity Free	CT20 KR Cavity Free	CT21 KR Cavity Free	CT22 KR Cavity Free	CT30 KR Cavity Free
1-2 times a month	2-3 times a month	3-4 times a month	4-5 times a month	5-6 times a month
Monthly or bi-monthly	Bi-monthly or monthly	Monthly or bi-monthly	Monthly or bi-monthly	Monthly or bi-monthly



## Fluoride and Fluorosis

- Fluoride is effective at reducing caries
- At optimal levels, fluoride is safe from a medical prospective
- Excessive intake causes enamel fluorosis
- In optimally fluoridated communities about 14-22% of the population experience mild/very mild fluorosis



## Recommendations for Fluoride

**Systemic Fluoride** (JADA, December 2010; vol 141(12); 1480-1489)

- Supplements should be prescribed only for:
  - Children at **high risk** of developing caries
  - Children whose primary source of drinking water is **deficient** in fluoride
- Topical Fluoride:** (JADA, 2014, Fluoride toothpaste use for young children)
  - All children should brush with fluoridated toothpaste



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## Sealants

**Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs.**  
JADA 2008

## Sealant Stats

- 90% of the caries experienced by adolescents occurs in the pits/fissures
- Sealant Utilization:**
  - Healthy people 2010 goal included increasing this to 50%
- Efficacy:**
  - Absolutely show a reduction in caries, especially in high risk children (Cochrane Review, 2013)
  - Effectiveness depends on long-term retention . . . so sealants should be replaced/repaired!

Wells, M., *Pit and fissure sealants: scientific and clinical rationale*.: In Pinkham JR, et al, editors: Pediatric Dentistry: Infancy through Adolescence, 5th ed. St. Louis, Elsevier, *in press*.

## Best Practices For Sealant Retention

- Preparing the tooth:**
  - The tooth does NOT need to be prepped
  - The tooth must clean – Use a dry toothbrush
    - Air polishing is superior but maybe not practical
- Isolation**
  - KEY! – 4 handed placement or isolite
- Etching**
  - Use a separate/total etch (not a self-etchant)

## Best Practices for Sealant Retention

- Bonding Agent**
  - Increases bond strength
- Curing**
  - 20 second cure with a High Powered LED; 40 second cure with a QTH or earlier generation LED

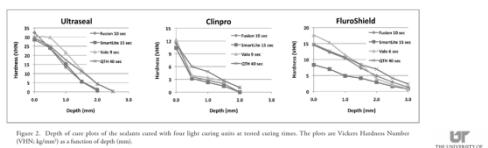
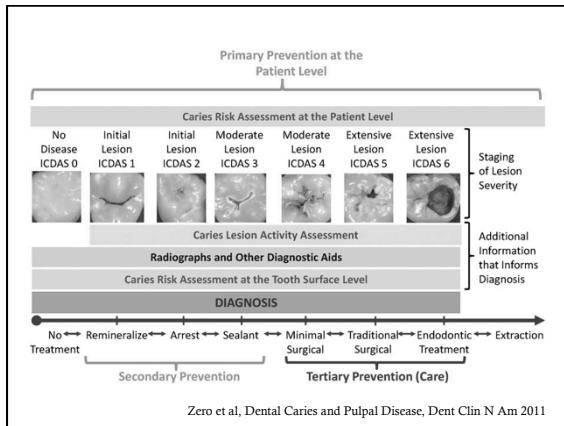


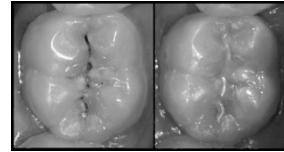
Figure 2. Depth of cure plots of the sealants cured with four light curing units at tested curing times. The plots are Vickers Hardness Number (VHN, kg/mm<sup>2</sup>) as a function of depth (mm).

**Another  
Paradigm Shift:  
The Seal is the  
Deal**

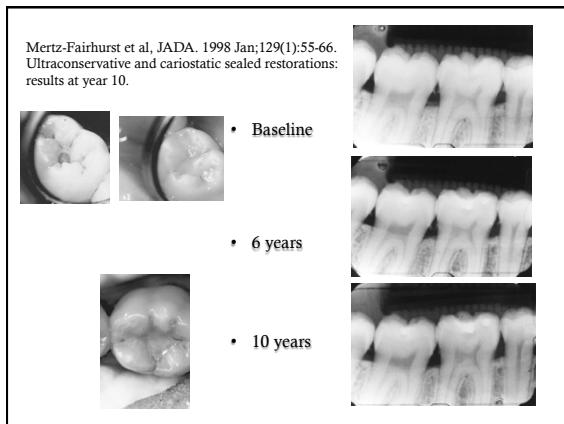


## Sealing Over Caries

- Not a new concept – published in 1998
- JADA's Evidence-Based Recommendations recommend sealing over incipient lesions in 2008



Many European countries do not place sealants until there is decay



## Are DDSs following EBD?

- Tellez et al. Sealants and dental caries: dentists' perspectives on evidence-based recommendations. JADA. 2011 Sep; 142(9):1033-40.
- 38.2% of dentists indicated that they would seal the lesion
- 37.2 % chose "watching" it
- 22.7 % chose opening the fissure and placing a small resin-based restoration or sealant

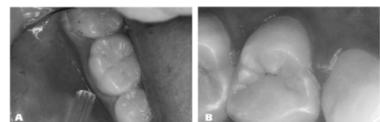
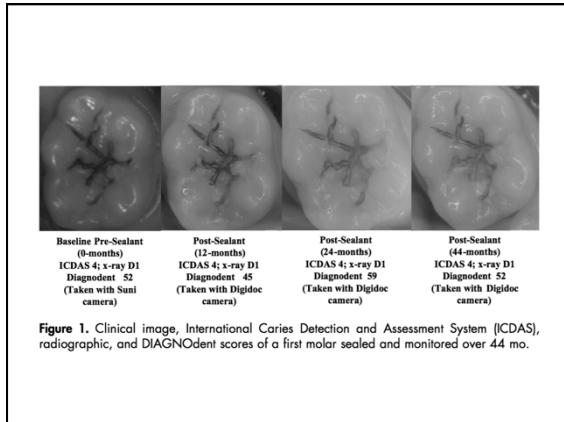


Figure. Teeth of a 12-year-old child. **A**, Permanent first molar. **B**, Premolar. Photographs provided courtesy of Dr. Amit I. Patel, the Detroit Dental Health Project (National Institute of Dental and Craniofacial Research grant U54 DE 14261-01).



## A Suspicious Lesion: What To Do Now?

- Choice 1: Watch It**
  - Watch it progress - progression of non-cavitated lesions in permanent teeth is slow – Ranges from 6-30%
  - Most recent trial of "monitoring" lesion progression showed less than 10% progress in a 3 year period (Brown et al, Community Dent Oral Epidemiol 2015; 43: 208–216)
- Choice 2: Place a Sealant**
- Choice 3: Restore Early**
  - Logical question: Wouldn't we conserve to intervened early?
    - Hamilton et al, Early treatment of incipient caries. JADA 2002; Dec

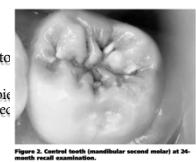


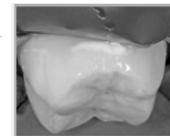
Figure 2. Central tooth (maxillary second molar) at 24-month recall examination.

## Other Disadvantages to Early Intervention:

- The earlier the age at restoration, the lower the longevity of the restoration**
- Re-restorations weaken the tooth**
- Eliminates the potential for small lesions to remineralize/arrest**
- Restorations are technique sensitive**
- Adjacent teeth may be damaged**
- Exposure of a child to a handpiece/local carries risks**

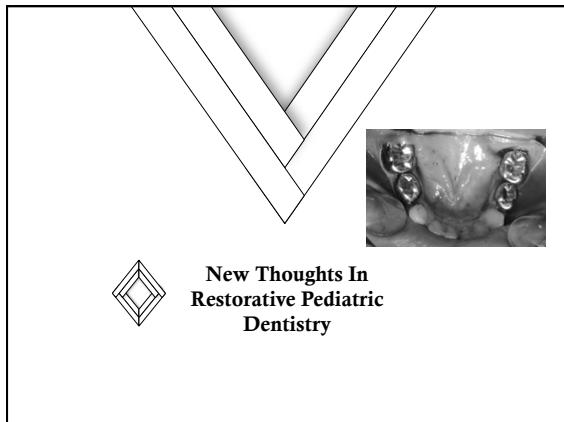
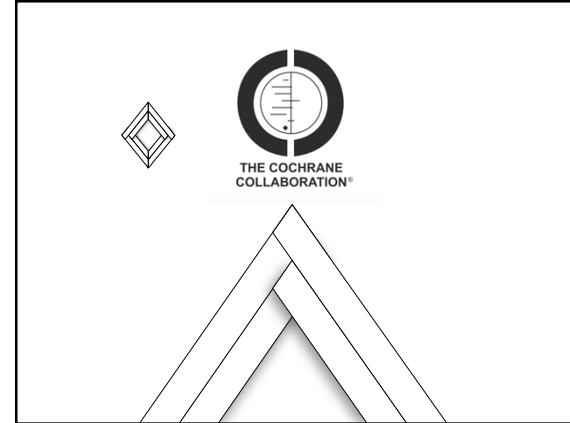
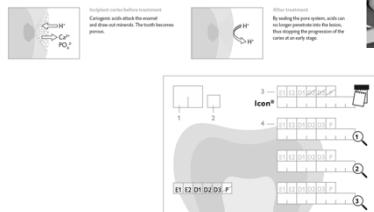
## Interproximal Sealants

- Dorri et al, Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth. Cochrane Database Syst Rev. 2015 Nov 5;11:CD010431
- Looked at protocols that sealed proximal surfaces or infiltrated them
- ICON - <https://www.dmg-dental.com/products/caries-infiltration/icon/>



## ICON

- Etch the interproximal surface
- Place resin infiltrate (it is clear)



## The Hall Technique

- Dr. Norna Hall, a general dentist working in Scotland began to use SSCs to seal caries in primary molars in the 1980s.
- The SSCs were cemented over carious primary molars – no tooth structure was removed, no local anesthetic was given (some topical for gingival) – she literally snapped them over untouched teeth, cemented with GI cement
- A retrospective analysis in 2006 showed the outcomes for this technique to be similar to outcomes reported for conventional restorations.

## The Hall Technique

University of Dundee

**The Hall Technique**  
A minimal intervention, child centred approach to managing the carious primary molar

[https://dentistry.dundee.ac.uk/sites/dentistry.dundee.ac.uk/files/3M\\_93C%20HallTechGuide2191110.pdf](https://dentistry.dundee.ac.uk/sites/dentistry.dundee.ac.uk/files/3M_93C%20HallTechGuide2191110.pdf)

The practical aspects of fitting a Hall Crown can be broken down into the following seven stages:

- Step 1. Assessing the tooth shape, anatomical form and the occlusion
- Step 2. Preparing the crown
- Step 3. Sealing a crown
- Step 4. Loading the crown with cement
- Step 5. Fitting the crown, and final stage sealing
- Step 6. Wipe the excess cement from the gingival area, check fit, and measure stage sealing
- Step 7. Final clearance of cement, check occlusion (adjusting crown if necessary) and discharge

22

## The Literature A Decade Later

- Innes NP, Stirrups DR, Evans DJ, Hall N, Leggate M. A novel technique using preformed metal crowns for managing carious primary molars in general practice - a retrospective analysis. *Br Dent J*. 2006;200:451-4, discussion 444
- Innes et al. The Hall Technique: a randomized controlled clinical trial of a novel method of managing carious primary molars in general dental practice: acceptability of the technique and outcomes at 23 months. *MC Oral Health*. 2007; 7: 18.
- Innes et al. Sealing caries in primary molars: randomized control trial, 5-year results. *J Dent Res*. 2011 Dec;90(12):1403-10.
- Santamaria et al. Caries management strategies for primary molars: 1-yr randomized control trial results. *J Dent Res*. 2014 Nov;93(11):
- Ludwig et al. The success of stainless steel crowns placed with the Hall technique: a retrospective study. *J Am Dent Assoc*. 2014 Dec;145(12):1248-53.
- Page et al. Acceptability of the Hall Technique to parents and children. *N Z Dent J*. 2014 Mar; 110(1):12-7.
- Schwendicke et al. Conventional treatment, Hall Technique or immediate pulpotomy for carious primary molars: a cost-effectiveness analysis. *Int Endod J*. 2015 Sep 1.

## Basics of Bonding: Primary Teeth

- Enamel: acid etchant removes the calcium from the hydroxyapatite crystals and resin tags enter the spaces within the crystal structure
- Dentin: acid etching exposes collagen and dentinal tubules and resin monomers envelop the exposed collagen and minerals to form the hybrid layer.
- Primary teeth differ from permanent teeth in:
  - Apismatic layer of enamel
  - Increased number of dentinal tubules with a larger diameter in the dentin of primary teeth
  - Decreased minerals in dentin
  - Primary dentin is more reactive to acidic conditions

## Basics of Bonding: Primary Teeth

- Bond Strength**
  - Shear bond strengths between 17-24 (21) MPa for permanent teeth are required to effectively resist the polymerization contraction forces of composite resin and to reduce microleakage to nearly zero (value not known for primary dentition).
- Microleakage**
  - When shrinkage stress exceeds bond strength, a gap is formed between tooth and restoration
  - Resins have a much larger coefficient of thermal expansion than enamel/dentin → percolation (pumping of saliva/bacteria through gaps in the periphery into the interior of a restored cavity)
  - Microleakage can affect esthetics with marginal discoloration; can cause sensitivity; can cause secondary marginal caries

## Microleakage: GI/Resin

(1) 476 µm  
(2) 1855 µm

Figure 2. Microleakage distances were measured at the occlusal and gingival margins of the restoration using imaging software.

Farmer et al. Microleakage of composite and two types of glass ionomer restorations with saliva contamination at different steps. *Pediatr Dent*. 2014 Jan-Feb;36(1):147.

Figure 1. Microleakage distance (mean and standard deviation) at the occlusal and gingival margins. Some bars indicate leakage levels that are not significantly different from the vertical level by Dunnett post hoc test, significance level  $P < 0.05$ .

Restorative System	Condition	Mean Microleakage (micrometers)
GI	no compaction	~2200
	compaction before placement	~2200
	compaction after placement	~2200
	no compaction	~2200
	compaction before placement	~2200
	compaction after placement	~2200
	no compaction	~2200
	compaction before placement	~2200
Composite	no compaction	~2200
	compaction before placement	~2200
	compaction after placement	~2200
	no compaction	~2200
	compaction before placement	~2200
	compaction after placement	~2200
	no compaction	~2200
	compaction before placement	~2200

## Esthetic Materials

Strip Crowns	Resin-Veneered
<ul style="list-style-type: none"> <li>• Conserves tooth structure</li> <li>• Very esthetic</li> <li>• Technique sensitive</li> </ul>	<ul style="list-style-type: none"> <li>• Aggressive tooth preparation</li> <li>• Not technique sensitive</li> <li>• Resin facing can debond</li> </ul>
	

## Introducing . . . Zirconia



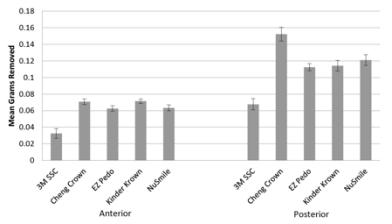
## Technique

- Incisal/Occlusal reduction: 1-2mm
- Buccal, Lingual, Interproximal reduction: 0.5-1mm
- Circumferential subgingival reduction: 1-2mm
- Feather margin
- Passive fit




## Aggressiveness of Preps

• L. Clark, DDS; M. Wells, DMD, MS; E. Harris, Ph.D., M.A., B.A., J. Lou, DDS. Is the Amount of Tooth Reduction Required for Pediatric Zirconia Crowns Comparable among Brands? *Pediatric Dentistry, in press.*

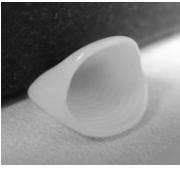


Region	Brand	Mean Grams Removed (approx.)
Anterior	3M SCC	0.03
	Cheng Crown	0.05
	EZ resto	0.05
	Vivadent Known	0.05
Posterior	3M SCC	0.06
	Cheng Crown	0.15
	EZ resto	0.11
	Vivadent Known	0.11
Posterior	NuSmile	0.12

UT TENNESSEE

## Zirconia

- Cementation is brand-dependent
  - Internal ridges
  - Phosphate bonds (Try-In Crown)
- What decreases bond strength?
  - Contamination (blood/saliva)
  - Autoclaving






## Parent Satisfaction and Cases

- Retrospective; 44 crowns in 18 children
- Avg follow up time: 20.8 months
- 96% of crowns were retained
- Majority of parents were pleased with the color, size, and shape of the crowns
- 83% of parents reported that they thought the crowns improved the oral health of their child
- Parents rated their overall experience with the crowns a 9.3 on a 10 point scale
- 89% said they would highly recommend the crowns to another parent



Figure 1. Maxillary incisors restored with EZ Pedo zirconia crowns, 7 months post-treatment.



Figure 2. 34 months post-treatment, the maxillary left central had 3+ mobility consistent with normal exfoliation.

UT TENNESSEE

D. Holstinger, DDS, M. Wells, DMD, MS, M. Scarbecz, M. Donaldson, DDS, Clinical Evaluation and Parental Satisfaction with Pediatric Zirconia Anterior Crowns, submitted to *Pediatric Dentistry*.

## Comparison

Characteristic	Strip Crown	Preveneered SSC	Zirconia
Overall Parental Satisfaction	Excellent	Very Good	Excellent
Esthetics	Excellent	Very Good	Excellent
Durability	Fair to Good	Fair to Good	Excellent
Prep Design	Conservative	Aggressive	Aggressive
Technique Sensitivity	High	Low	Low
Gingival Health	Fair to Good	Good	Good
Cementation	Micromechanical bond to tooth	Relies on the strength of the cement	Some chemical bonding; mainly relies on cement

## To Pulp or Not to Pulp

**And if I Pulp,  
What Do I Use?**

## Definitions

- Pulpotomies are **VITAL** pulp therapies
  - A with a healthy pulp
  - Reversible pulpitis: one that is reversibly inflamed (not infected)
  - 1/3 of the root remains
- NOT candidates for pulpotomies:
- Irreversible pulpitis - spontaneous pain or pain or sensitivity to percussion
- Necrotic – parulis; resorption

## Choices

- Formocresol – 1923
- Ferric Sulfate - 1991
- MTA - 2001
- Sodium Hypochlorite – 2006
- Biodentine - 2015

## Formo

- Formo - most studied pulpotomy agent
- Success: 55-98%
- Fixes surface tissue, pulp is not expected to heal
- Concerns for systemic distribution, carcinogenicity, mutagenicity, distant site genotoxicity, immune sensitization
  - Milnes AR. Persuasive evidence that formocresol use in pediatric dentistry is safe. J Can Dent Assoc. 2006 Apr;72(3):247-8.
- 1:5 dilution performed by a compounding pharmacy should be used

## Ferric Sulfate

- Success rates of 74-97%
- Agglutination of blood proteins results from the reaction of blood with ferric and sulfate ions and with the acidic pH of the solution. The agglutinated proteins forms plugs that occlude the capillary orifices.
- Can induce significant internal resorption but not often enough to really decrease its radiographic success rate in RCTs.
- Currently, most practitioners' choice for an aldehyde-free pulpotomy agent

## MTA

- High success rate: 94-100%
- Biocompatible and one of the only medicaments
- Major contender: "superior to formocresol"
- Expensive but new delivery systems



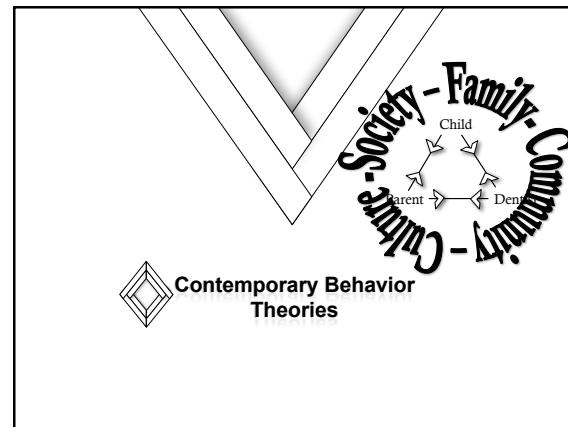
## Base

- ZOE/IRM – time tested
  - Eugenol can have a potential impact on the pulp which is why it seems that protected radicular pulp (i.e. those with a barrier – FC, MTA, Biobond) may have better outcomes
- TempIt/Cavit/Interval



## Indirect Pulp Cap

- Indications:
  - Asymptomatic, absence of clinical and radiographic signs of irreversible pulpalitis or necrosis
- Success rates: 73-95%
- Technique:
  - Local anesthesia and rubber dam
  - Remove undermined enamel
  - Remove infected dentin
  - Place glass ionomer and restorative material



## The Parent

- Families provide children with physical needs, emotional support, socialization, coping methods and life skills.
- The quality of family life will have a direct impact on the behavior of a child.
- Understanding parenting styles and family dynamics is crucial to engaging in the first steps of behavior guidance.

## Parents

- Current trends:
  - Parents overwhelmingly prefer to be present
  - Parental presence is increasing in medicine and dentistry (a 10% increase in pediatric dentists allowing parents back for almost all procedures from a decade ago)



## Parenting Styles

- Authoritarian – high rules, low affection
- Authoritative – high rules, high affection
- Permissive – low rules, high affection
- Neglectful – low rules, low affection

## Questions to Better Understand the Parent

- What best describes your family's style of making decisions?
- It is best to give your children choices instead of telling them what to do.
- I generally need to ask more than once to get my child to do something.
- Ask about mealtimes, bedtime, toilet training
- Parent's level of anxiety

Adapted from Behavior Management in Dentistry for Children, Wright and Kupietzky, 2014

## The Parent



- Parent Cooperation Scale
  - PCS 1 – definitely negative
  - PCS 2 – negative
  - PCS 3 – positive
  - PCS 4 – definitely positive
- Parents are able to predict child's behavior

Kupietzky et al, Parental cooperation scale in the pediatric dentistry setting: reliability and criteria. J Clin Pediatr Dent. 2012 Winter;37(2):157-61.

## Preparing the Parent

- Prepared parents are more likely to comply with requests, less likely to interrupt the procedure, and are more positive about treatment
- Medicine has shown that many common behaviors of parents are actually “distress-promoting” to their children.

## Distress Promoting Behaviors



- Uninformative reassuring comments
- Giving control to the child
- Apology
- Demands to the provider
- Empathy
- Confusing statements

## Coping-Promoting Behaviors

- Distraction
- Humor
- Prompt the child to employ a coping strategy
- Reframing the situation
- Consider a handout for parents

## Impact of Family Stress

- SES – most powerful predictor of health and disease
  - Neurogenomic differences in environmental susceptibility
    - Low and High reactors (Boyce, 2014)
- Epigenetics - heritable changes in gene expression that are not encoded in the DNA sequence itself
- Children from “stressed family situations” were more likely to be uncooperative (Gustafsson, 2007)

## Cultural Influences

- Build a framework for understanding cultural values
  - Who makes decisions for the family?
  - Personalismo vs. “inappropriate” physical contact
  - Is it a past-oriented culture? (ie. Do they believe in doing things the way they have always been done?)
  - What is the degree of respect for a provider’s authority?
- May use qualified interpreters



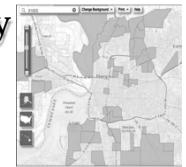
## 4 C's of Culture

- **Call:** What do you call your problem? What do you think is wrong?
- **Cause:** What do you think caused your problem?
- **Cope:** How do you cope with your problem – what have you done to try and make this better?
- **Concerns:** What are your concerns regarding the condition? How serious do you think this is?

Goleman, PEDIATRIC DENTISTRY V 36 / NO 2 MAR / APR 14

## Influence of Poverty

- Children in poverty experience both food and housing insecurity
- Different values to items than middle class individuals: food, language, time
- Low SES = poorer health outcomes
  - Food availability and quality (food desert)
  - Physical environment (broken playgrounds, unsafe streets)
- Poor early language development – 30 million word gap



<http://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas.aspx>

## Classifying behavior



## Classifying Child Behavior

### The Frankl Scale

- F1 – definitely negative (-)
- F2 – negative (-)
- F3 – positive (+)
- F4 – definitely positive (++)
- Pre-cooperative



### The Importance of the Dental Home

- Modeled after medical home which is associated with better preventive health and lower resource utilization like emergency rooms for primary care
- Prevents the “first visit” from being an emergency visit
- A long relationship with a child allows additional learning and “reframing” of experiences after difficult procedures



### Effective Communication

**Caveat: Pain Control Is Essential**



### Questions That Can Help Predict Behavior

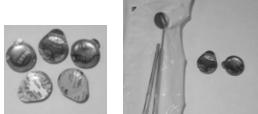
- How is the child performing in school or learning?
- Does the child think he has anything “wrong” with his teeth?
- How anxious are you at this visit?
- How do you think your child has done with past medical visits?
- How do you expect your child to react in the dental chair?

### Techniques Supported with Evidence

- Pre-Appointment Behavior Modification
  - Website, pre-appointment letter in the mail, email
- Distraction\*\*
- Tell Show Do: clear, concise messages
- Positive Reinforcement: specific praise
- Modeling
- Nonverbal communication
- Parental presence/absence

### Unconstructive Techniques

- Rhetorical questions
- Coercing and Coaxing
- Non-specific praise
- Giving explanations
- Reassurance
- Punishment/Belittling
- Denying/Ignoring
- Too Many Choices



### Tips for Difficult ?s

- Find out what the child already knows
  - Am I going to get a shot?
  - Are you going to pull my tooth?





## What influences pain perception?

- Fear of pain (anticipation)
  - Increased anticipation on the part of the patient usually leads the patient to feel more intense pain during LA
  - Advise parents to not say anything about a shot
  - Also advise parents to not talk about how bad a past visit was (medical literature shows that exaggerated children's memories of pain/anxiety was associated with higher distress at the subsequent visit)
- Perception of needle and syringe
- Technique of administration

## Do Topicals Work?

- Yes - acts both pharmacologically and psychologically
  - Works better than a placebo (Meechan, 2002)
  - Subjects who are told they are going to receive a topical for comfort anticipate less pain
  - Medical literature meta-analysis concludes that pain is lower in children who receive topicals prior to immunizations  
(Shah et al, Clin Therapeutics, 2009)



## Topical Options

- Lidocaine patches
  - Can use the lowest concentration and still get effect (ie. 10% vs. 20%)
- 5% lidocaine
  - 2 minute application resulted in analgesic effect with 2mm needle insertion
- 20% benzocaine
  - More effective than placebo with 2 or 3 min application

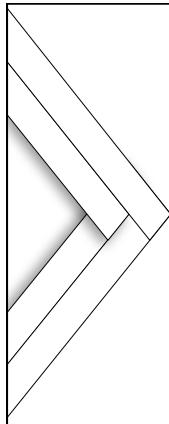
## Options . . .

- EMLA (eutectic mixture of 2.5% lido and 2.5% prilo)
  - Reduced pain of palatal injection with 5 minute application; Intraoral use is "off-label;" didn't differ from placebo at 2 mins
- Compounded Topicals
- Cooling the injection site (vapocoolant/ice)



## Improving Your Use of Topicals

- DRY the mucosa
- Minimize taste
  - Survey of pediatric dentists reported that 89% of their patients didn't like the taste of topicals
- Duration of application matters
  - Lidocaine patches = 5 minutes (there is no difference in a patch and a placebo at 2.5 minutes)
  - Benzocaine = 2-3 minutes
    - More efficacious the longer it contacts the tissue (studies show 5 mins > 1 min > 30 seconds)



## Local Anesthetics

### Efficacy Reducing Injection Pain



### Efficacy

- Mandibular Infiltration vs. Block in Primary Teeth
  - Adequate anesthesia *can* be achieved to accomplish restorative work
  - No robust support for more complex procedures like pulpotomies and extractions
- Mandibular Infiltration vs. Block in Permanent Teeth
  - Most studies done with articaine
  - Adequate anywhere from 50-75% of the time

## Soft Tissue Injury: Blocks

- Incidence of soft tissue trauma is approx 13%
- No contraindication to bilateral blocks (actually showed less soft tissue trauma than unilateral blocks)
- Higher incidence in younger children with highest incidence in children under 4 years of age



### The Needle

- Gauge (the higher the number, the finer the needle)
  - A number of studies show needle gauges in the range of 25-30 do not affect injection discomfort
- Needle Condition
  - Needles are blunt after the first time they are used – they are often deformed after penetrating mucosa and hitting bone
  - Sharpness of the needle matters: used needles produce more discomfort than new ones (Meehan et al, 2005)

## The Site

- Least painful: maxillary posterior infiltration
- Most painful: Nasopalatine>Max anterior
- A block vs. an infiltration for the mandible
  - Multiple studies of pediatric patients have shown no difference between the two for child behavior or pain experience

## Epinephrine

- Epinephrine doesn't cause pain
- Using Mepivacaine plain or Prilocaine plain does not result in a less painful injection
  - Mepivacaine plain = lidocaine (Wahl, 2006)
  - Prilocaine plain = lidocaine (Wahl, 2001)
- Both are more "concentrated" at 3% and 4%, respectively

## Warming and pH Buffering



<http://www.onpharma.com/MixingPen.html>

- Still out for debate in dentistry
  - Only one study in pediatric dentistry for warming of anesthetic = no difference (Ram, 2002)
  - 2 studies in dentistry for buffering anesthetic = no difference
- However, medical literature shows definite advantage as multiple medical studies report that buffered solution decreases pain of injections (ie. bone marrow procedures, laceration repairs, etc.)

## Reducing the Pain of Injection

- Inject SLOWLY (1 min per 1 mL)
- Distraction
  - Verbal Distraction
  - Counter Stimulation (shaking the cheek)
  - Audiovisual
- Use Nitrous! It's an analgesic and studies show it raises the pain threshold and reduces pain of injection (Jacobs, JADA, 2003)

## CCLAD: Computer Controlled LA Delivery

- The first of these CCLAD devices: the Wand™
- Literature is conflicting with some studies reporting significant pain reductions and others reporting no difference
  - Most likely the difference is in rate of injection
- Advantages:
  - Devices do not look like a needle
  - Administer LA continuously and immediately ahead of the needle
  - Study has shown patients prefer CCLAD over traditional injections
- Disadvantages:
  - Expensive



<http://www.septico.com/store/anesthesia-delivery/the-wand-all-injection-system/#prettyPhoto>

## Choice of Anesthetic

- 2% Lidocaine; 1:100,000 epinephrine is the workhorse in pediatric dentistry
- 4% Articaine:
  - For pediatric patients, studies show that the efficacy and reaction to pain for articaine and lidocaine are similar
  - The manufacturer doesn't recommend articaine's use in children under 4
- 3% Mepivacaine plain
  - associated with a disproportionate number of local anesthetic toxicity reports

## Avoiding Overdose

- Must dose based on weight

Drug	Maximum Dose	Max Total Dose
Articaine	7 mg/kg	500
Lidocaine	4.4 mg/kg	300
3% Mepivacaine plain	4.4 mg/kg	300
4% Prilocaine plain	6 mg/kg	400

## After the Appointment

### Post-op Pain Management

## Who Will Experience Post-Op Pain?

- Roughly 30% of children report pain after routine dental procedures
  - *Younger* children more likely to experience pain
- Procedures most likely to cause pain?
  - Extractions
  - Stainless Steel Crowns (with or without a pulpotomy)
    - More than 50% of children report post-operative pain with this procedure
- Almost all children who are treated in the operating room and receive full mouth rehabilitation report pain

## Pre-emptive Analgesia

- Pre-emptive: giving pain medicine prior to the surgical event
- In medicine, studies have shown reduced total pain and decreased pain intensity if pain meds are given before significant post-operative pain is felt
- In one study in children, giving children Ibuprofen prior to primary tooth extraction lowered pain scores during extraction and post-operatively (Baygin, 2011)

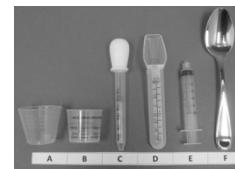
## Overview



- Always use weight-based dosing
- Opioids – should start at low end of therapeutic range and titrate based on pain scores and side effects
- Parents will benefit from guidance and education on dosing

## Improving Pain Management

At Home

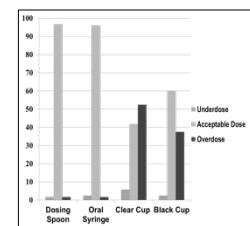


## Parental Dosing Errors

- Almost 1/3 of parents are considered to have low health literacy
- Contributes to difficulty understanding and implementing medication instructions, and it has been specifically linked to medication administration errors
- Several studies have shown that parents do not read a dosing chart correctly
- Parents tend to dose based on age and not weight
- Good resource: [knowyourdose.org](http://knowyourdose.org)

## Helping Parents

- Choice of measuring device:
- Parents tend to measure too much medicine in a medicine cup
- They syringe is the most accurate device and the dosing spoon is the next best choice



## Parent Education

- Delegate parent education to a staff member
  - ✓ Help parents read a dosing chart
  - ✓ Include dosing calculations on your written post-op instructions
  - ✓ Show parents how to use an oral syringe
  - ✓ Help parents understand: "More is not better" and "Not Enough" is sub-therapeutic!

## ATC not PRN



- Pain medicines should be administered "Around The Clock" for the first 36-48 hours and not "as needed"
- Why?
  - Creates stable plasma levels of analgesics
  - Parents tend to underestimate their children's pain
  - Decreases chance of breakthrough pain
  - PRN can mean "not given"

## Choosing an Analgesic



## Ibuprofen

- Dose: 5-10mg/kg q6-8h (max 3200 mg/24hr)
- Most cases of postoperative pain after dental procedures have an inflammatory component so Ibuprofen = first-line treatment
- Contraindicated in bleeding disorders, ulcers, renal disease
- Cautioned in patients with asthma as there are case reports of ibuprofen induced bronchospasms

## Acetaminophen

- 10-15mg/kg q4-6h (max 3000mg/24hr)
- Most commonly used pediatric pain med in the US
- NO anti-inflammatory properties
- Overdose causes hepatic failure
  - Has received a lot of attention due to the numerous cases of acetaminophen overdose that occur each year

## Alternating Dosing Schedule

- Alternating ibuprofen and acetaminophen every 3 hours
- Effective and safe for short periods of time
- Disadvantage: the frequency of dosing
  - Will our patient's social situation allow compliance with such a frequent dosing schedule?
  - If children are likely to only receive a dose or two of pain medication at home, a single medication therapy may be better than an alternating one
- Consider dosing/time chart to help parents

## Opioids

- Still the gold standard for treating moderate to severe pain in children
  - Codeine
  - Hydrocodone
  - Oxycodeone
- FDA cut acetaminophen dose in all opioid painkillers to 325mg or less



## Codeine

- It is an old drug so it continues to be widely prescribed for children – however, it has an **unpredictable pain response** and a **high level of nausea, vomiting, and constipation = less than ideal pediatric analgesic**
- Dose: 0.5-1mg/kg/dose codeine q4-6h (duration of narcotic is 3-4 hrs)

## Ultra-Rapid Metabolizers

- Cytochrome P450 2D6 (CYP2D6) is a liver enzyme that is responsible for breaking down (metabolizing) many of the drugs that are commonly used today.
  - Converts codeine to morphine
- Poor-Metabolizers = Painkiller doesn't work
- Ultra-Rapid Metabolizer = Normal dose of codeine gets metabolized into an increased dose of morphine
  - Recent FDA warning given some children are "ultra-rapid" metabolizers

## Hydrocodone

- **0.2mg/kg/dose of hydrocodone; q4-6h**
- Most commonly prescribed analgesic in the US
- Should be effective for "non-metabolizers" of codeine (Prodrug of hydromorphone (dilaudid))
- Increasingly prescribed for children b/c **it is better tolerated (less nausea/vomiting)**
- Schedule II – requires a written prescription

## Hydrocodone

- Available as:
  - Lortab Elixir: 10 mg/300 mg/15 mL elixir
  - Hycet Elixir: 7.5mg-325mg/15mL
  - Tabs: 5 mg hydrocodone/325 mg acetaminophen

## Lortab Elixir

Body Weight (kg)	Approximate Age (years)	Dose every 4-6 hours	Maximum Dose per day
12 to 15	2 to 3	2.8 mL	16.8 mL
16 to 22	4 to 6	3.75 mL	22.5 mL
23 to 31	7 to 9	5.6 mL	33.6 mL
32 to 45	10 to 13	7.5 mL	45 mL
46 and up	14 to adult	11.25 mL	67.5 mL

## Hycet Dosing Schedule\*

Body Weight	Approx Age	Dose q4-6h	Max total daily dose
12 to 15 kg	2 to 3	3.75 ml (3/4 tsp)	4.5 tsp (22.5ml)
16 to 22 kg	4 to 6	5 ml (tsp)	6 tsp (30 ml)
23 to 31 kg	7 to 9	7.5 ml (1.5 tsp)	9 tsp (25 ml)
32 to 45 kg	10 to 13	10 ml (2 tsp)	12 tsp (60 ml)
46 kg and up	14 to adult	15 ml (tbsp)	6 tbsp (90 ml)

\*The recommendation for hydrocodone is 0.1-0.2 mg/kg/dose with the usual dose being 0.135mg/kg

## Don't Be a Barrier

- Aggressive prevention of pain is better than treatment because, once established, pain is more difficult to suppress
- Do not fear the narcotic if it is indicated.
- Prescribe a **therapeutic** dose.
- Ask your patients at subsequent visits about post-op pain experience (over time this will give you an idea of how children are reacting to normal operative procedures)

## Objectives

- Propose behavior guidance techniques for clinical examples
- Identify approaches to prevent and manage the microbial aspects of dental caries
- Apply evidence to predict the survival rate of different restorative materials
- Describe indications for vital and non-vital pulp therapy in primary teeth
- Explain some of the errors that can lead to under-treatment of pain in children

## Thank You!

