

## TIPS AND TRICKS FOR TREATING KIDS

### NEW PARADIGMS IN PEDIATRIC RESTORATIVE DENTISTRY



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2

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3

## Affirmation and Disclosures

- ▶ No financial ties to drug or equipment companies to disclose
- ▶ No direct payments from manufacturers
  - ▶ Have received supplies for workshops and products to test from manufacturers



4

## You do what you were taught in dental school despite life and research passing you by

- ▶ Journals
  - ▶ Check for the ads next to the articles
- ▶ Lay publications
- ▶ Internet
- ▶ Peer reviewed?
- ▶ Bias?



5

## Evidence Based Medicine Evidence Based Dentistry

- ▶ ... an approach to medical practice intended to **optimize decision-making** by emphasizing the use of evidence from **well-designed and well-conducted research**.
  - ▶ Wikipedia
- ▶ ... conscientious, explicit, judicious and reasonable use of modern, best evidence in making decisions about the care of individual patients. EBM integrates clinical experience and patient values with the best available research information.
  - ▶ Swanson et al. *Plast Reconstr Surg* 2010 Jul; 126(1):286-294
- ▶ All in the name of creating practice guidelines

6

## Who is doing the talking?

- ▶ Sales reps with vested interests?
  - ▶ Their product is NEW, "significantly" better, faster acting
  - ▶ Proprietary v Generic
  - ▶ Sales incentives
  - ▶ Sunshine laws
- ▶ Researcher?
  - ▶ Industry v Academic
    - ▶ Who is funding?
    - ▶ Bias in outcome?
- ▶ Influencer
  - ▶ A private practitioner who receives product and funding from a dental company
  - ▶ Not uncommon on iPeDo
  - ▶ Check <https://www.cms.gov/OpenPayments>
  - ▶ Sunshine law disclosures



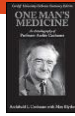
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“

## Live and Die by Cochrane Reviews

”

[HTTPS://WWW.COCHRANELIBRARY.COM/](https://www.cochranelibrary.com/)



8

## Rules of the Road

- ▶ Kids aren't scary but PARENTS are
- ▶ You are bigger/smarter/wilier/more manipulative than them
- ▶ Learn their language
- ▶ Learn their "heroes"
- ▶ Compliment them and their clothing
- ▶ Talk continuously/ Sing Often
- ▶ BE YOURSELF!



9

## Behavior Management in Children and Especially Parents



10

## Behavior Management in Children

- ▶ Non-pharmacologic
  - ▶ Exploration/Modeling
  - ▶ Tell/Show/Do
  - ▶ Desensitization
  - ▶ Distraction
  - ▶ Voice Modulation
  - ▶ Behavior Modification
  - ▶ PEDI-wrap/papoose/medical immobilization device



11

## Behavior Management in Children

- ▶ Pharmacologic
  - ▶ Used in conjunction with non-pharmacologic
  - ▶ Inhalational
    - ▶ N<sub>2</sub>O/O<sub>2</sub>
  - ▶ Oral (Enteral) Sedation
    - ▶ Benzodiazepine/ Narcotic
  - ▶ Sedation (Parenteral)
  - ▶ General Anesthesia



12

If only it was this simple!



13

## Be yourself but keep talking

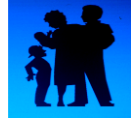
- ▶ Children hate silence
- ▶ Learn the current TV and pop stars
- ▶ Age appropriate banter
- ▶ Compliment clothing (no matter how despicable)



14

## Choosing the Behavior Management Technique for Ma and Pa

- ▶ Family
  - ▶ The "make it or break it" factor
  - ▶ Preconceived notions
    - ▶ child "needs" sedation
    - ▶ "won't do well"
    - ▶ "is anxious"
  - ▶ Don't want sedation, GA, restraints, etc...
- ▶ Their past experience
  - ▶ Transferred or projected feelings
- ▶ Requests
  - ▶ "no pain"
  - ▶ "don't want my child to remember..."
- ▶ Their needs
  - ▶ One visit
  - ▶ Multiple visits



15

## Parents Out of the Treatment Room

- ▶ Pros
  - ▶ No hindrance therefore faster
  - ▶ Only one explanation needed
  - ▶ Children may behave better without the parent
  - ▶ Behavior management is more immediate
  - ▶ Child doesn't perceive harmful situation "save me"
- ▶ Cons
  - ▶ Two explanations needed means more time
  - ▶ Return to parent for procedural change
  - ▶ Child lacks parental support
  - ▶ What do you do at the MD?



16

## Parents In the Treatment Room

- ▶ Pros
  - ▶ Supports child
  - ▶ Observe procedure and difficulty
  - ▶ Decrease office time
  - ▶ Immediate informed consent
  - ▶ Liability issues
- ▶ Cons
  - ▶ In the way
  - ▶ Over involved
  - ▶ Take over
  - ▶ More time to explain



17

## Parental Presence During Induction of Anesthesia (PPIA)

- ▶ PPIA
  - ▶ Predicting which child-parent pair will benefit from parental presence during induction of anesthesia: a decision making approach, Kain et al. Anes Analg 102:1, pp81-84, 2006
- ▶ CC+CP= **NO CHANGE**
- ▶ CC+AP=**AC**
- ▶ AC+CP=**CC**
- ▶ AC+AP= **DISASTER!!!**

Calm Child	Calm Parent
Anxious Child	Anxious Parent

18

## Rules of the Continuum of Behavior Management

- ▶ It is not linear
- ▶ It is not one way
- ▶ It is okay to combine techniques
- ▶ On different days, the same child will need different techniques
- ▶ Be flexible/ give the child the benefit of the doubt
- ▶ Define or modify your definition of success



19

## Communication

- ▶ Still possible!



20

## Exploration/Modeling



21

## Tell/Show/Do

- ▶ Tell once/show once/do once
  - ▶ Set limits on negotiations
  - ▶ Always have a mirror



22

## Desensitization

- ▶ Expose by working up to the event
- ▶ Start on hand where the child can see and move towards mouth



23

## Distraction

- ▶ Take attention away from procedure through Ericsonian hypnosis
  - ▶ Visual
  - ▶ Auditory
  - ▶ Engaging activity
  - ▶ Storytelling
  - ▶ Singing
  - ▶ Counting
  - ▶ Deep breathing



24

## iPads and Injections

- ▶ CHILD LIFE IPAD DISTRACTION: A PSYCHOSOCIAL TOOL FOR CHILDREN RECEIVING AN INJECTION. S Afencio, U. Alabama 2015
- ▶ "...children receiving distraction during the injection using a tablet reported higher pain, both observed and self-reported, and more negative emotions showing distress"
- ▶ "This finding suggests that children who received distraction using the tablet displayed less coping than those who received routine care"



25

## Distraction

- ▶ Computer Tablet Distraction in Children Receiving an Injection
  - ▶ Sherwood Burns-Nader, PhD, CCLS, Stephanie Atencio, MS, CCLS, Magdalena Chavez; Pain Med (2016) 17 (3): 590-595.
- ▶ 41 children, randomized, received injection
- ▶ A significant difference was found for pain, both self-reported and observed, and observed emotions. Children receiving distraction using a tablet displayed significantly higher amounts of pain and negative emotions. Gender differences in pain and emotions were found with females having a significantly higher amount of pain and negative emotions.

26

## Another iPad View

- ▶ The iPad provides effective distraction for induction of sedation/general anesthesia or reduction of injection pain.
- ▶ Also may be more effective than parental presence for reducing anxiety.
- ▶ McQueen A, Cress C, Tothy A. Using a tablet computer during pediatric procedures: A case series and review of the "Apps". Pediatr Emerg Care 2012;28:712-714.

27

## Smile!

- ▶ Research has shown that if a patient smiles during a painful procedure they experience less pain
- ▶ Sardonic smile



The Emoji by Unknown Author's licensed under CC BY-SA

28

## Voice Modulation

- ▶ Raising or lowering volume, tone or inflection
- ▶ Not well accepted by parents
- ▶ May signal displeasure
- ▶ Follow by positive reinforcement



29

## Behavior Modification

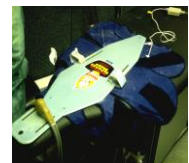
- ▶ Positive reinforcement
- ▶ Follows desirable behavior
- ▶ Work up to goal
- ▶ Positive or negative reinforcement may be used
  - ▶ Long term effects are eliminated
- ▶ The TOY is KING!
  - ▶ Remembered long after the visit is over



30

## Medical Immobilization Device

- ▶ Papoose board, Restraining device, soft wrist restraints, head immobilizers
- ▶ Mustn't be tightened such that it causes injury or restricts ventilatory movements
- ▶ Must allow free access to monitors
- ▶ Office protocol for use (prevents accusations of assault or child abuse)
  - ▶ i.e., 15 min in unsedated child except in emergency
- ▶ Consent for use
  - ▶ May have parent assist in placement of child
- ▶ Neck roll to open airway



31

## How we see children



The Simpsons  
Season 4  
Episode 17

David L. Hoffman MD 2019

32

## A Little Prevention Goes a Long Way

Trying to change parents and kids' behavior (while keeping your sanity)



33

## The Ten Killer Questions

- ▶ "What do you mean that I should have brought my child in between 18 and 24 months?"
- ▶ or: "My pediatrician didn't tell me that."



34

## The Answers

- The AAPD recommends the first visit when the first tooth erupts or sooner
- Provide counseling via risk assessment
- Nutrition and diet review
- Safety check
- Note that the pediatrician may see a child 15 times before the child visits the dentist



35

## The Answers



Candida



Riga-Fede

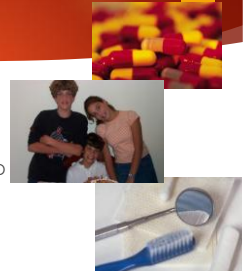


- ▶ General Dentists and Pediatricians need to be trained in identifying and diagnosing oral diseases including hard and soft tissue pathoses
- ▶ They are part of the team responsible for the "Dental Home" and fluoride applications
- ▶ See [www.AAP.org/oralhealth](http://www.AAP.org/oralhealth)

36

## Caries Risk Assessment

- ▶ History
  - ▶ medical
  - ▶ dental
  - ▶ social
  - ▶ fluoride
- ▶ CAT: caries assessment tool; AAPD
  - ▶ Minimum, moderate, severe



37

## Caries Risk Assessment

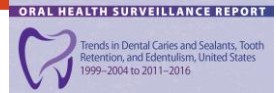
- Many available
- AAPD [www.aapd.org](http://www.aapd.org)
- CDA CAMBRA [www.cda.org](http://www.cda.org)
- ISDA
- Even the pediatricians are claiming this area
  - [www.aapd.org/oralhealth/cme](http://www.aapd.org/oralhealth/cme)
- All provide a systematic approach and a pathway for diagnosis and treatment
- Decide how complicated you want to be
- Must be recorded!



38

## CDC Report on Oral Health

- ▶ 2019
- ▶ Increase in caries rates in preschoolers
  - ▶ 28% will demonstrate ECC
  - ▶ Up 5 percentage points from 2014
- ▶ Stabilized rates in elementary and middle schoolers
- ▶ Increased rate in high schoolers
- ▶ <https://www.cdc.gov/oralhealth/publications/OHSR-2019-index.html>



39

## Definitions

- ▶ Cavity: a hole in a tooth; may be developmental or bacterial
  - ▶ +/- surface cavitation
- ▶ Caries: a biofilm mediated transmissible, bacterial disease
- ▶ Early Childhood Caries: caries of infants, toddlers, and young children affecting one or more teeth



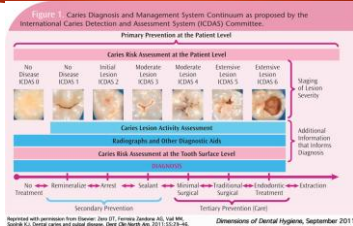
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## Early Childhood Caries

- ▶ **Early childhood caries (ECC)** is the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child **71 months of age or younger**.
- ▶ In children **younger than 3 years of age**, any sign of **smooth-surface caries** is indicative of **severe early childhood caries (S-ECC)**.
- ▶ From ages **3 through 5**, 1 or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or a decayed, missing, or filled score of **>4 (age 3)**, **>5 (age 4)**, or **>6 (age 5)** surfaces constitutes **S-ECC**.

41

## International Caries Detection and Assessment System (ICDAS)



42

## ADA Caries Classification System

American Dental Association Caries Classification System.

ICDAS	ICDAS 0	ICDAS 1	ICDAS 2	ICDAS 3	ICDAS 4	ICDAS 5	ICDAS 6
ICDAS 0	ICDAS 1	ICDAS 2	ICDAS 3	ICDAS 4	ICDAS 5	ICDAS 6	ICDAS 6

Additional information that informs diagnosis: Staging - 4 Lesion Severity

43

## Sugar doesn't cause cavities- acid does!

- ▶ Mutans strep and Lactobacillus make acid
- ▶ 5 fruits to an 8oz. glass of juice
- ▶ Approx. 1 tsp = 5g sugar
- ▶ 12oz. Soda=39g. of sugar
- ▶ 12oz. JuiceBlast=40g. of sugar
- ▶ Carbonic acid/Phosphoric acid/Citric acid
- ▶ The two hour rule



44

## The Y2K Bugs

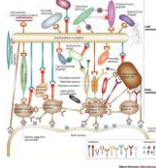
- ▶ Over 800 oral strains
- ▶ Mutans streptococci
- ▶ Lactobacillus
- ▶ Candida albicans
- ▶ Other acidogenic strains that may break down sucrose
- ▶ Virulence!
- ▶ Produce acid for 1.5hr
  - ▶ In plaque
  - ▶ Between teeth



45

## Biofilms!

- ▶ 80% of infectious diseases are biofilm mediated
- ▶ Multiple organisms interacting
  - ▶ Can be benign individually; together wreak havoc
  - ▶ *P. gingivalis*
- ▶ Traditional treatment
  - ▶ Antibiotics
  - ▶ Mechanically debride
  - ▶ Opens up avenues to other potentially pathogenic strains that live in symbiosis
- ▶ New treatment
  - ▶ Change environment and ecology
    - ▶ Non-fermentable sweeteners
    - ▶ Prevent adhesion of bacteria
      - ▶ Xylitol
      - ▶ Stevia from tree free pollen (stevia leaves)
    - ▶ Change pH
      - ▶ Arginine to help,
      - ▶ Xylitol
  - ▶ Helps fight the threat of organisms on the growth and biofilm formation of oral biofilms. [www.ncl.ac.uk](http://www.ncl.ac.uk) October 2017. Pages 24-26



46

## And Where Do Those Germs Come From?

- ▶ Getting tooth decay is an infectious disease
- ▶ Mom is vector between 13 and 29-39mos. and up to 6
  - ▶ All bacteria, cariogenic and noncariogenic, are transmitted
- ▶ Some research now challenges this!



47

## Erosion v Decay

- **Erosion**
- **Deminceralization or dissolution** of the carbonated hydroxyapatite crystal of enamel/dentin of the tooth in an **acidic environment** reversed by a neutral or basic oral environment in which minerals redeposit on the tooth surface.
- **Caries**
- A **bacterial mediated deminceralization** of the enamel/dentin in which a sugar substrate is metabolized by various bacteria. Their metabolic waste product deminceralizes the tooth in a **localized area** protected by plaque. Reminceralization occurs at a rate slower than deminceralization and the bacteria move into the cavitation that develops.



48

## Attrition, Abrasion and Erosion

- ▶ **Attrition:** physiologic wear from mastication
  - ▶ Normal!
- ▶ **Abrasion:** pathologic wear of teeth from mechanical rubbing
  - ▶ Brushing, toothbrush and toothpaste wear
  - ▶ Brush lightly not hard- bristles don't move!
- ▶ **Erosion:** pathologic wear from chemical dissolution
  - ▶ Acidic foods/drinks, GERD

Table: Eccles and Jenkins erosion scale. Each exposed tooth surface (Buccal, lingual, occlusal, or incisal) is scored.	
Grade 0	No erosion
Grade 1	Erosion into enamel only, no exposure of dentin
Grade 2	Less than one third of surface has dentin exposed
Grade 3	One third or more of surface has dentin exposed

49



## pH of Common Foods

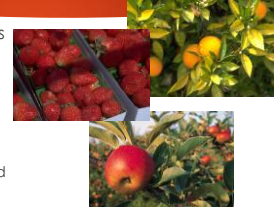
- ▶ Beverages
  - ▶ Coffee 2.4-3.3
  - ▶ Tea 4.2
  - ▶ Beer 4.0-5.0
  - ▶ Wine 2.3-3.8
  - ▶ Soda (sweetened or non-sweetened) 2.7-3.5
  - ▶ Sports drinks 2.3-4.4
  - ▶ Saliva 7.4



50

## pH of Common Foods

- ▶ Fruits and Vegetables
  - ▶ Tomatoes 3.7-4.7
  - ▶ Apples 3.5-3.9
  - ▶ Plums 2.8-4.6
  - ▶ Strawberries 3.0-4.2
  - ▶ Vegetables 3.9-5.1 (+ sand/soil for an added measure of abrasion)



www.sciencedaily.com

51

## Soda: the tooth killer

- ▶ liquid candy
- ▶ high fructose corn syrup
- ▶ +/- caffeine
- ▶ Carbonic acid from CO<sub>2</sub>
- ▶ Phosphoric acid
- ▶ prolonged exposure
- ▶ even non-sweetened, diet products **AND SPARKLING WATERS**
- ▶ Causes erosion and if sugar present, decay



52

## Soda: the tooth killer

- ▶ And we're not done yet!
  - ▶ Sweet soft drinks, fructose linked to gout
  - ▶ Children's salt intake is reduced when soda is out of their diet
  - ▶ Weight gain is recorded on people who drink diet sodas
    - ▶ Reason unknown- sweet tooth means more calories?
- ▶ But, thankfully, sales are on the decline!?!?
  - ▶ Juice sales are up
  - ▶ Sports drink sales are up



53

## And You Thought Soda Was Bad...

- Juice
  - Liquid candy- no nutritional value other than what's added
  - 5 fruits to make 8oz.
  - Soda=39g sugar/12oz.
  - Juice esp. boxes=40g/12oz.
  - Fructose and high fructose corn syrup 3-5X sweet as table sugar
    - Breakdown to glycogen and stored as fat
  - Natural v unnatural sugar? Bacteria care?
  - May be a source of high levels of F<sup>-</sup>
  - Just give a glass of water and a multivitamin

54

## Saliva: the wonder drug

- ▶ Neutralizes acid with phosphate buffer returning oral cavity to basic environment
  - ▶ Stops demineralization
  - ▶ Promotes remineralization
- ▶ Contains Ca<sup>++</sup>, PO<sub>4</sub><sup>-</sup>, OH<sup>-</sup> and F<sup>-</sup> (exogenous)
  - ▶ Remineralizes early decalcification in a basic environment
- ▶ Antibiotic/antiviral
- ▶ Enzyme system that breaks down food especially carbs to simple sugars!
- ▶ Washes away food substances
- ▶ The more the better!!!!



55

## Salivary pH After Eating



56

## Sports Drinks and Soda

- ▶ A. Milosevic, Brit J Sports Med, 3/97
- ▶ pH 4.46-2.38
  - ▶ demineralization occurs at 5.5 or below
- ▶ High sugar and fructose corn syrup
- ▶ Citric acid
- ▶ Viscosity
- ▶ Temperature (cold is better)



57

## Sports Drinks v Energy Drinks

- Energy Drinks
- Sports drinks + caffeine (methylxanthines) + Vit B
- Herbs +/- carbonated water, guarana, yerba mate, acai + taurine, ginseng, malto-dextrin, inositol, carnitine, creatine, glucuronolactone and ginkgo biloba
- Ginseng and guarine increase risk of intraoperative bleeding through decreased platelet aggregation.
  - J Oral Maxillofac Surg 70:1439-1441, 2012
- Others may contain alcohol
- Highly toxic
- Have caused hospitalization and death in children and adults
- <http://pediatrics.aappublications.org/content/early/2011/05/25/peds.2011-0965>



58

## Sports Drinks v Chocolate Milk

- Chocolate Milk
- Low fat or non fat
- Better hydration
- Less salty
- Correct mineral balance
- Like drinking a glass of milk and 2 oreo cookies
- Similar to "energy milks"
- [http://www.acsm.org/AM/Template.cfm?Section=About\\_ACSM&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=14752](http://www.acsm.org/AM/Template.cfm?Section=About_ACSM&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=14752)



59

## Carbohydrates



- ▶ Very cariogenic (more so than sucrose)
  - ▶ 4X daily
  - ▶ >60 g per day
- ▶ Break down to simple sugars by salivary enzymes
- ▶ Adhere to teeth and gums
  - ▶ Glycans (a polysaccharide)



60

## What About the Milk Substitutes?

- ▶ Soy Milk (100 calories)
  - ▶ Isoflavones
    - ▶ Phytoestrogens
    - ▶ Menopausal symptoms (hot flash)
    - ▶ Estrogens which raise LDL
  - ▶ Brown rice syrup or re-sprouted corn juice
    - ▶ linked to insulin resistance for obesity, type 2 diabetes
- ▶ Rice Milk (140 calories)
  - ▶ brown rice syrup
- ▶ Almond Milk (60 calories)
  - ▶ Omega 3 fatty acids
  - ▶ Antioxidant V E
  - ▶ Total carbs 2 g (0 sugar)
  - ▶ 1 g of protein
- ▶ Coconut Water (60 cal/11oz)
  - ▶ 61mg K (1/4 banana)
  - ▶ 5.45 mg Na
  - ▶ Not a good sports drink for rehydration
  - ▶ No clinical studies support the claims
- ▶ Yellow Pea Protein Milk
  - ▶ 10g of protein
- ▶ Oat Milk
  - ▶ 19.2g of carbs
  - ▶ 4.5g of fat



61

Brand	pH	Water Source & Treatment Notes
Whisper	3.4	Demineralized with Minerals & Fluoride Added
Prong Zero Activella	3.5	Demineralized with Minerals & Fluoride Added
Prong Fitness Water	3.6	Demineralized with Minerals & Fluoride Added
Pureit	4.0	Demineralized, Demineralized & Further Processed
Smart	4.5	Filtered, Alkaline Added, Chlorinated
Function	5.0	Distilled with Minerals Added
Perrier	5.5	Filtered, Carbonated Water Derived From Wells
Alkaline Spring	5.8	Derived From Springs & Distilled Water
Viva	6.0	Well Water From Norway
Ice Mountain	6.0	Demineralized, Filtered, Chlorinated
Crystal Geyser	6.0	Filtered Mountain Water
Star Park	6.3	Derived From Springs & Distilled City Water
Smart Water	6.5	Filtered, Distilled & Re-mineralized
Great Value Wellburt	6.5	Filtered, Alkaline Added, Chlorinated
Gerber Pure Water	6.5	Demineralized with Minerals Added
Armahead	6.9	Derived From Springs & Distilled City Water
Dasani	7.0	Derived From Springs in France
Eternal	7.0	Filtered, Treated Spring Water
Wahic	7.0	Filtered, Treated Spring Water
Zephyrus	7.5	Filtered, Treated Spring Water
Allegro	7.5	Filtered, Treated Spring Water
Fiji	7.5	Derived From Springs in Fiji
Super Chll	7.5	Filtered, Treated Spring Water
Evian	8.0	Filtered Well Water
Real Water	8.0	Filtered Treated Water
Essencia	8.0	RO Filtered, Minerals Added, Treated Water



<https://www.alkalinewaterplus.com/analyzing-comparing-brands-of-bottled-water/>

62

## Good Plaque v Bad Plaque

- ▶ Good Plaque
  - ▶ Basic pH
  - ▶ Ca<sup>++</sup>, PO<sub>4</sub><sup>-</sup>, F-
  - ▶ Casein (a protein which helps bond the minerals to the tooth) in CPP-ACP and CPP-ACFP products
- ▶ Bad Plaque
  - ▶ Fermentable Carbs
  - ▶ Sucrose
  - ▶ No proteins
  - ▶ Lots of bacteria



63

## The Miracle Sugar: Xylitol?



- ▶ Low calorie, sugar-alcohol (polyol) that is not metabolized by bacteria (5 carbon v 6 carbon)
- ▶ Inhibits biofilm adhesion
- ▶ Short term use decreases S. mutans in saliva
- ▶ When used in place of sugar, stops caries progression by up to 70%
- ▶ Ablation therapy: Decreases transmission of S. mutans from mother to child
- ▶ Commercially available as gum, candy, toothpaste, energy bars
- ▶ Higher doses cause severe diarrhea (similar to fructose)

64

## Xylitol Gum Studies



- ▶ Finland
  - ▶ Original studies in '80s at Turku University
- ▶ Caries in 4 year old children after maternal chewing of gums containing combinations of xylitol, sorbitol, chlorhexidine and fluoride
  - ▶ EAPD, 2006
  - ▶ Fewer caries were observed in children whose mothers chewed xylitol only gum at the time of the eruption of the first primary teeth.
- ▶ New studies (2015) show effective only with F-

65

## Xylitol: Hype and Reality

- Must have > 1.55g/serving TID
- Should be listed as first ingredient
- Sorbitol may also be effective
- Commercial and specialty availability
- Gums: Altoids cinnamon, Koolerz, Starbucks peppermint and cinnamon, xylitol Beechies, TheraGum, Spry, Xylifresh, Xylichow
- Toothpastes: Tom's mint with fluoride and apricot with fluoride, Crest multicare (sorbitol), Xylifresh, XylilWhite, Squigle
- Mints: TheraMint, Xlear, Xylichow, Clen-Dent

66

## The Ten Killer Questions

- ▶ "Is it okay if I give my child toothpaste from the health food store?"
- ▶ Or: "Why does my child need fluoride?"



67

## The Answers



- ▶ Toothpaste is a vehicle to carry fluoride
- ▶ Only ADA/CDA accepted products have been tested
- ▶ Fluoride is a naturally occurring mineral which is found in many water systems
- ▶ Does not affect the immune system or any other system
- ▶ And twice a day more than doubles the efficacy of the F-
  - ▶ A single use has little effect
  - ▶ Saliva reservoir

68

## How Much Toothpaste?

- ▶ There is no difference between F- content of children or adult toothpastes
  - ▶ Intensity of flavorings and additives
- ▶ Training toothpastes are simply sodium lauryl sulfate (soap)
  - ▶ May be reduced fluoride concentration
- ▶ Unless labeled differently are 1000ppm (1mg/ml or 1" long strip)
  - ▶ Same as Prevident 1000
- ▶ Dose is controlled by size and ingestion
  - ▶ Pea sized v Rice sized v Shmear between 1/8 and ¼ mg



69

## How Fluoride Works



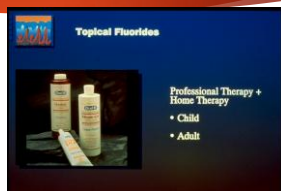
70

## Daily Fluoride Intake



71

## In-Office Fluorides



72

## What does F- do and how do it do it?

- ▶ Substitutes for OH- groups in hydroxyapatite to produce fluorhydroxyapatite
  - ▶ More acid resistant in outer layers
- ▶ As CPP-ACPF reduces biofilm adhesion
  - ▶ By blocking enolase system in Mutans streptococci
  - ▶ Produces F- resistant strep mutans which produce less acid
  - ▶ Casein assists in the process of bonding the fluoride
  - ▶ Xylitol as the sweetener also has antibacterial effects
- ▶ Now available as an OTC daily use toothpaste besides Rx mousse and in office varnish
- ▶ Rothman DL. Remineralization Therapy for Children. Inside Dental Hygiene, Jan 2022.

73

## And What About Just Plain Water?

- ▶ Non fluoridated does little
  - ▶ Frequency of brushing over teeth important
  - ▶ Most bottled water unless labeled has no fluoride
  - ▶ Most filters, depending on age, reduce [F<sup>-</sup>] by 30-70%
    - ▶ Reverse osmosis F<sup>-</sup> stripping?
- ▶ Must consider supplementation
  - ▶ Remember ocean H<sub>2</sub>O is 1.5 ppl
  - ▶ Tap water is 0.7 ppl
  - ▶ Apple juice can reach 6 ppl
  - ▶ Fluoridated salt available in many countries
    - ▶ Mexico, France



74

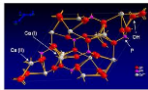
## Remineralization Therapies

- ▶ The "new" hot-button topic for tooth sensitivity
- ▶ All are based on calcium and phosphate remineralization
- ▶ 3 basic technologies
  - ▶ Amorphous calcium phosphate ± casein phosphopeptide
    - ▶ Works best as nanoparticles and F<sup>-</sup> present
  - ▶ Calcium sodium phosphosilicate
  - ▶ Arginine bicarbonate and calcium bicarbonate

75

## Recalifying Systems

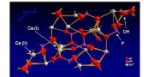
- ▶ MI plus paste CPP-ACP (Rx)
  - ▶ Research has shown equivocal results
  - ▶ Better results with CPP-ACPF
- ▶ Available as a non-Rx formulation as a toothpaste Mipaste One
  - ▶ CPP-ACPF
- ▶ Nanoparticle hydroxyapatite remineralization gel (Rx)
  - ▶ pH neutralization (5.5) plus nanoparticles more effective
  - ▶ 1.1% sodium fluoride



76

## And Why Might Fluoride Not Work and Remineralize Teeth???

- ▶ Fluoride chelates all available Ca<sup>++</sup> especially when in high concentration
  - ▶ 5000 ppm
  - ▶ 5% NaF
  - ▶ F varnish (5.5% NaF = 2.26% F<sup>-</sup> = 22,600 ppm)
- ▶ Fluoride is considered a micronutrient
  - ▶ Available as a salt (NaF or KF) in non fluoridated countries and areas
  - ▶ Mexico, Canada and Europe
- ▶ Makes it unavailable to become carbonated fluorhydroxyapatite
  - ▶ NaF produces a hard outer shell without affecting the inner layers of dentin preventing remineralization



77

## What About All Those Hot New Toothpastes?

- ▶ Ferric pyrophosphate and Sodium hexametaphosphate, antiplaque/anticalculus agents, keep minerals bound in saliva and prevent deposition
- ▶ May actually prevent remineralization
- ▶ Crest Prohealth has both stannous fluoride and sodium hexametaphosphate: dueling purposes?



78

## Prebiotics/Probiotics

- ▶ Found in yogurt as live cultures to improve GI "balance"
  - ▶ High sugar content in kids
- ▶ Claimed to promote "healthy" balance of good v bad bacteria in the mouth and in gut
  - ▶ Sold as mints
  - ▶ Use after dental prophylaxis for 10 days
    - ▶ To restore and promote good bacteria removed during procedure
  - ▶ Then a maintenance version every day
    - ▶ Allegedly decreases oral malodor
  - ▶ One study from J Appl Micro in 2009 cited by manufacturer
    - ▶ Others are "4-week lab study"
    - ▶ Some recent articles in peer reviewed journals about (H) efficacy
- ▶ Advised against in pts who are immunocompromised
- ▶ **The health benefits of currently available probiotics and prebiotics have not been conclusively proven.**
  - ▶ Katherine Zeratsky, R.D., L.D., Mayo Clinic
  - ▶ [mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/expert-answers/probiotics/faq-20090604](http://mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/expert-answers/probiotics/faq-20090604)



79

## The Ten Killer Questions

- ▶ "But do I really have to brush their teeth?"
- ▶ Or "Johnny won't let me brush his teeth"
- ▶ Or "He doesn't like the taste of toothpaste"



80

## The Answers

- ▶ Commonly known as the "who's the parent?" question
- ▶ Set up home routines
  - ▶ one person/two people
- ▶ Tooth-brushing probably doesn't stop tooth decay, fluoride does
  - ▶ To decrease plaque and gingivitis
- ▶ Stress diet/frequency issues/fluoride
- ▶ Make it a science fair experiment



81

## BUZZ, WIGGLE . . . AND RINSE

Brushed and rinsed is no question. New electric toothbrushes oscillate, wiggle, and vibrate. Many brush electric cost about \$50 to \$150, but

Colgate Crest, and Oral-B have introduced models that cost far less. A dentist studies who brush with oscillating brushes returned to test each of four electric brushes—three inexpensive ones and a much pricier model that is widely advertised—after their usual brush. All four electric are advertised as able to clean teeth better than a regular brush does.

The volunteers used each brush for about a week. To get used to it, left their teeth unbrushed for a day. To let plaque build up, then let a dentist we tested in a computer examine their teeth. He scored the amount of plaque on specific teeth, asked each model to brush, then measured those teeth to gauge a brush's plaque-removal prowess. (Plaque removal is central to preventing cavities and gum disease.)

The bottom line: Even the most effective (and expensive) electric brush in our test, the Sonicare Elite 7000, didn't prove to be better

than a regular brush costing \$3 to \$5. And every brush garnered at least one complaint about noise and annoying vibration.

What matters most, it turns out, is your technique and how long you brush. Toothbrush makers usually recommend two minutes. There's little real potential advantage of electric brushes. Our volunteers, who brushed for as long as they thought necessary, tended to brush longer when using electric. In fact, all but one electric lasted power throughout enough to consider switching from regular electric toothbrushes are

not a boon for people with weak hands or limited dexterity.

If you think the fun factor will keep you or your kids brushing longer try the Colgate AirBrush. It costs only \$15 and contains a built-in timer that alerts you when it's time to stop.

The ratings include each brush's features. The Sonicare is rechargeable and comes with a charging station and a timer that indicates brushing time. Two months after a check of soft or medium bristles, the others have only soft.



Model	Price	Plaque removed	Features
Colgate AirBrush	\$15	100%	Timer, soft bristles
Oral-B Pro 1000	\$40	100%	Timer, soft bristles
Sonicare Elite 7000	\$150	100%	Timer, soft bristles, rechargeable
Colgate Crest	\$50	100%	Timer, soft bristles

82

## And When Should You Brush?

- ▶ NOT AFTER MEALS!!!
  - ▶ Especially if acidic food eaten or drunk and demineralization is occurring
  - ▶ Will remove outer layer of weakened enamel promoting erosion
- ▶ Wait at least .5-1 hour
  - ▶ Let saliva do its work
  - ▶ Recent research says maybe necessary
- ▶ Now is controversial
  - ▶ Not enough remineralization up to 4 hours after eating
  - ▶ Rinse gently with water
  - ▶ Create basic environment



83

## And How Hard?

- ▶ Very light pressure
- ▶ Bristles should barely flex
- ▶ Toothbrush trauma
  - ▶ Resorption
  - ▶ Abrasion and laceration
- ▶ Electric v Manual
  - ▶ No Difference!!!
  - ▶ 2020



84

## And While We're At it... How Often?

- ▶ Recent studies show that once a day with fluoride toothpaste is not as effective as twice a day
- ▶ The differences are not additive but are exponential



85

## And, of course, how long?

- ▶ 2 minutes?
  - ▶ Brushing less than 2 min associated with higher caries risk
    - ▶ JDR, 2016, systematic review 33 articles
  - ▶ Brushing for 1 minute removes 27% of plaque, 2 minutes removed 41% of plaque
    - ▶ IJDH, 2012, systematic review of 59 articles



86

## The Ten Killer Questions

- ▶ "And now I suppose you're gonna want me to floss...?"
- ▶ Or "You must be joking?"



87

## The Answers



- Cavities form either on top of or between the teeth
- Germs live between and the teeth and they and their food need to be removed
- If there is space between the teeth, the toothbrush and saliva work well
- If the teeth are touching, there is no way to clean between the teeth without floss- **the in-between brush**
  - Use the hand washing analogy between fingers
- Recommend alternatives to holding the floss
  - Disposable/reusable flossers

88

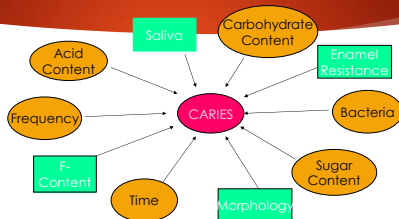
## The New Shape of Dental Caries

- Resistant enamel because of fluoride
- Weaker, nonfluoridated dentin
- Ballooning out under the enamel surface with extensive spread
- Poor diagnostic techniques
  - explorer
  - radiograph
  - Laser/Diagnodent (Kavo)



89

## Caries is Multifactorial!!



90

## Treatment Modalities

- Habit/Diet/frequency of eating
- Decrease fermentable carbohydrate and sugar content
- Remove/disrupt biofilm
- Alternative Medicine Therapies- not tested/approved
  - Oils
    - Oil Pulling (coconut oil)
- Chemotherapy
  - Xylitol topical application
    - Gum/candy/lozenges
  - Topical fluoride use
    - Gels/pastes/varnish
  - Chlorhexidine use does not decrease incidence of coronal caries
  - Silver diamine fluoride
  - Interim restorative(AE)/VSR(palliative)
    - Glass ionomer (fluoride releasing)
    - Lucitone posts
- Definitive treatment



91

## Treatment v Restorative Dentistry

- ▶ Treatment
  - ▶ Arrest caries
  - ▶ Strengthen dentin and enamel
  - ▶ May retain plaque and biofilm
    - ▶ Motivational training
  - ▶ Temporization or final restoration
  - ▶ Pain and sensitivity relief
- ▶ Restorative dentistry
  - ▶ Return tooth to form and function
  - ▶ Arrest caries
  - ▶ Strengthen tooth
  - ▶ Minimize plaque and biofilm retention



92

## Oh No!!!



- ▶ Proceedings of the Symposium on Innovations in the Prevention and Management of Early Childhood Caries
  - ▶ Oct. 23-24, 2014, Ellicott, Md
- ▶ Evidence of Effectiveness of Current Therapies to Prevent and Treat Early Childhood Caries; S. Twetman, V. Dhar (2015)
  - ▶ 877 reports, 33 met criteria
  - ▶ Fluoride toothpaste and varnish: *limited evidence*
  - ▶ Fluoride tablets and drops: *insufficient evidence*
  - ▶ Silver Diamine Fluoride, Xyitol, Chlorhexidine varnish/gel, Povidone Iodine, Probiotic Bacteria, Remineralizing agents (ACP-CP): *insufficient evidence*
  - ▶ Sedatives, restorations, regular restorations: *insufficient evidence*
- ▶ **THERE IS NO EVIDENCE THAT ANYTHING WE DO WORKS!!!**

93

## The Ten Killer Questions

- ▶ "Do you really have to do that?"
- ▶ Or "Aren't they going to fall out anyway?"



94

## The Answers

- Yes, they do
- There is an infection in the tooth that must be cured
- Baby teeth are important for
  - eating
  - maintaining space for the permanent teeth
  - speech
  - growth and development of the face and arches



95

## Restoring Primary Teeth



96

## Ralph at the Dentist



97



## Pain Control in Children

- ▶ Necessary for successful treatment
- ▶ Poor pain control often misinterpreted for disruptive behavior
- ▶ Requires special understanding of physiology and psychology of children



98

## Pain in Children

- ▶ The response to the sensation of pain is often confused for disruptive behaviors
- ▶ May be socialized but is real
- ▶ Must be recognized as an important entity
- ▶ Changes in physiologic parameters
- ▶ Difficult to assess in children under 6
  - ▶ Use observation
- ▶ Self reporting in children over 6
  - ▶ Pain scales
- ▶ *It is the key to a successful treatment (child and parent)!*



99

## Don't waste your money on expensive anesthetics

- ▶ 2% Lidocaine with 1:100000 epi
  - ▶ Wide margin of safety
  - ▶ Full mouth with two carpules
  - ▶ Lasts too long!
  - ▶ Amide anesthetic
    - ▶ Metabolized in the liver
  - ▶ High pKa therefore slower dissociation to free base
    - ▶ Infection has lower pH, limits free base
- ▶ 4% Articaine with 1:100000 epi
  - ▶ Amide/ester
  - ▶ transient methemoglobinemia



100

## Commonly Used Local Anesthetic Agents Dose Recommendations from AAP/AAPD

Drug	Maximum dose with epinephrine (mg/kg)	
	Medical Use	Dental Use
Lidocaine	7.0	4.4
Articaine	7.0	7.0 (4.4)

■ Determined by relative vascularity of injection area

Guideline for Monitoring and Managing Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures, AAPD Reference Manual 2006-2007

101

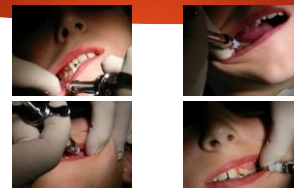
## Moore's Rule of 25

- ▶ One cartridge/25 lbs (11 kg) body weight
- ▶ Any marketed local anesthetic used in dentistry
- ▶ Establishes a conservative dose
- ▶ Examples:
  - ▶ 50 lbs. (22 kg)            2 carpules
  - ▶ 75 lbs. (33 kg)            3 carpules
  - ▶ 100 lbs. (44 kg)          4 carpules
- ▶ May be too conservative in preschool child
  - ▶ More accurately 1 carpule/22 lbs (10 kg)
- ▶ mg/kg calculation provides greater accuracy

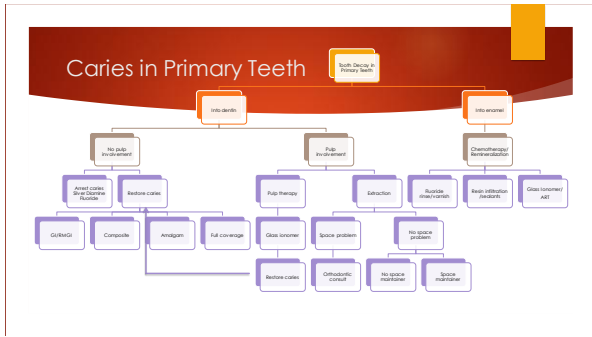
■ Moore P., Manual of Local Anesthesia, 4th ed. Eastman-Kodak Co., Rochester, NY, 1996

102

## Infiltration Technique



103



104

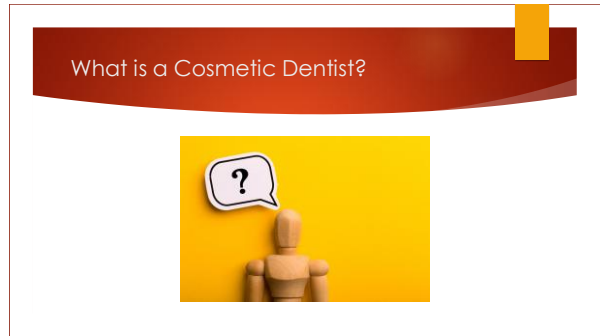
- ## All Teeth with Decay Have to Be Restored?
- ▶ Form and function
  - ▶ G.V. Black
  - ▶ Alternatives-but for how long?
    - ▶ SDF
      - ▶ The new Messiah or just another arrow in the quiver
      - ▶ Produces hard outer shell of hyperfluorinated enamel but much underneath
      - ▶ Diagnostic critical depth/pulp
    - ▶ Frequency
    - ▶ Vanishes
    - ▶ Frequency
    - ▶ CONACD superior and deeper penetration
  - ▶ ART/RE/RR
    - ▶ GI palliative

105

## The Alphabet Soup of Restorative Dentistry for Moderate and Severe Caries: CIR

- ▶ CIR: carious tissue removal
- ▶ NCR: nonselective caries removal
  - ▶ All tissue removed until hard dentin
- ▶ SCR: selective caries removal
  - ▶ CIR until soft or firm dentin reached
  - ▶ Partial or complete caries removal
- ▶ SCR: stepwise caries removal
  - ▶ CIR until soft dentin reached; place temporary
  - ▶ Go back in X time and do complete removal if hard dentin then permanent restoration
- ▶ NCR: no carious tissue removal
  - ▶ No tissue removed prior to placing a permanent restoration
  - ▶ Think Half crown
  - ▶ NND: no drill dentistry

106



107

## Please Define

- ▶ Dan Ericson, What is minimally invasive dentistry? Oral Health Prev Dent 2004;2 Suppl 1:287-92
  - ▶ application of "a systematic respect for the original tissue,"
  - ▶ tissue preservation, preferably by preventing disease from occurring and intercepting its progress
  - ▶ removing and replacing with as little tissue loss as possible
  - ▶ bridges the traditional gap between prevention and surgical procedures

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108

## Minimally Invasive Dentistry



Does not mean painless dentistry!  
Does not mean you don't have to remove tooth tissue-just less.  
Does not mean you don't have to go in and prevent future issues  
Doesn't mean you don't have to do a restoration  
Consider an ongoing process of prevention and treatment

What are the goals?  
Temporization?  
Relief of Pain?  
Restore the teeth to form and function?  
Speed?  
Increased revenue?

109

## Monitored Decay

- Watchful waiting
- Diet control
  - Varnish (5.5 mg NaF/package, ~2.24mg F, 22.400ppm) 1/wk x 3
    - Varnish with Fluorides (CFP-ACR) better option
- Mouthrinse (1000 ppm)
  - Water
- Multiple applications
- SDF
  - Multiple applications
- Attraumatic Restorative Technique (ART) / Interim Restorative Technique (IRT) / Interim Therapeutic Restoration (ITR)
  - Partial coats removal
  - Placement of glass ionomer restoration
    - Non-shading
  - Carostatic
  - Similar to Indirect Pulp Cap

110

## And What About Old Technology?!?


- Silver Nitrate
  - Silver is a natural antibiotic
    - 100:3:3 to tooth water
    - Silver salivation was used to treat typhoid and cancer sores
    - More effective than mercury containing compounds
    - Non-toxic
  - Has carostatic effect
    - Can be mixed with fluoride and gives superior results
      - 30S Silver Diamine Fluoride
        - 2007ppm Ag+ = 4800ppm F-
        - JDR, Feb 2009, Vol82, pp116-120, pp44-447
        - Am J Clin Microbiol and Antimicrobiol 19(2), 2013
      - 1.73X as effective as IRT (85% v 43.4% caries arrest)
      - Int Dent J 42(4):51, 2012
    - Leaves black crust which can be covered by GI
      - Adaptation may be Silver Nitrate (used only in 2nd trimester)
      - +/- Decreases bonding strength to GI
    - FDA breakthrough therapy designation 2016 for caries arrest




111

## SDF

- Arrests caries Stops them dead in their tracks!
- Heavy duty marketing
- Multiple applications over varying periods of time
- Many articles and case studies but not much "research"
  - Low to very low quality of recommendation
- Holds kids until old enough to behave without GA or until age of three
- Cosmetically poor: Turns everything black in its path
- 2 step products add KI over to diminish color change
- Interim treatment not restoration or repair
- Remineralizes the decalcified dentin
- Antibacterial
- Has a place: occlusal surfaces of cavitated teeth NOT proximal surfaces
- Be sure to get consent for color and staining



112

## Evidence-Based Clinical Practice Guideline on Nonrestorative Treatments for Carious Lesions: A Report from the American Dental Association

Summary of the recommendations for the management of caries in primary teeth

GRADE Certainty in the Evidence	GRADE Interpretation of Strength of Recommendations	Recommendation	Strength of Recommendation
<b>High</b> The evidence is likely to be accurate, precise, reliable, and free of bias. The confidence in the estimate of effect is high. The risk of bias is low.	<b>Strong</b> The evidence is likely to be accurate, precise, reliable, and free of bias. The confidence in the estimate of effect is high. The risk of bias is low.	<b>Apply SDF</b> The application of silver diamine fluoride (SDF) to arrest carious lesions in primary teeth is recommended.	<b>Strong</b>
<b>Low</b> The evidence is likely to be imprecise, unreliable, or possibly biased. The confidence in the estimate of effect is low. The risk of bias is high.	<b>Weak</b> The evidence is likely to be imprecise, unreliable, or possibly biased. The confidence in the estimate of effect is low. The risk of bias is high.	<b>Apply SDF</b> The application of silver diamine fluoride (SDF) to arrest carious lesions in primary teeth is suggested.	<b>Weak</b>
<b>Very Low</b> The evidence is very likely to be imprecise, unreliable, or possibly biased. The confidence in the estimate of effect is very low. The risk of bias is very high.	<b>Very Weak</b> The evidence is very likely to be imprecise, unreliable, or possibly biased. The confidence in the estimate of effect is very low. The risk of bias is very high.	<b>Apply SDF</b> The application of silver diamine fluoride (SDF) to arrest carious lesions in primary teeth is suggested.	<b>Very Weak</b>

ADA Center for Evidence-Based Dentistry®

113

## Silver Diamine Fluoride: the new savior?

### Use of Silver Diamine Fluoride for Dental Caries Management in Children and Adolescents, Including Those with Special Health Care Needs

Developed by Pediatric Academy of Pediatric Dentistry

**Abstract**  
This manuscript presents evidence-based guidance on the use of 38 percent silver diamine fluoride (SDF) for dental caries management in children and adolescents, including those with special health care needs. A guideline was developed by the American Academy of Pediatric Dentistry (AAPD) and the American Academy of Pediatric Dentistry (AAPD) based on a systematic review of the literature. The guideline is intended to assist pediatric dentists in the management of dental caries in children and adolescents, including those with special health care needs. The guideline is based on a systematic review of the literature and is intended to assist pediatric dentists in the management of dental caries in children and adolescents, including those with special health care needs. The guideline is based on a systematic review of the literature and is intended to assist pediatric dentists in the management of dental caries in children and adolescents, including those with special health care needs.

114

## So What Could Go Bad with SDF?

- 38% SDF was cytotoxic to hDPSC at a dilution of 10:3 but not at 10:4 or 10:5
  - Exposure of 38% SDF directly to the pulp should be avoided
  - Cropeza R et al. Cytotoxicity Analysis of Human Dental Pulp Cells After Silver Diamine Fluoride Application. Pediatr Dent 2022;44(6):440-4
- Rat pulp cells exposed to 38% SDF showed signs of severely impaired viability, mineralization instability and change in morphology
  - Kim S et al. The effect of reduced glutathione on the toxicity of silver diamine fluoride in rat pulp cells. J Appl Oral Sci 2021; 29e20200859

115

## Is SDF better than RMGI for indirect pulp capping?

- ▶ Is ART better or what?
- ▶ No clinical difference between 38% SDF, 38% SDF covered with KI or RMGIC
  - ▶ In pulp health and pain
  - ▶ RMGIC better color, and better marginal staining
    - ▶ Barako M et al. Twelve month randomized controlled trial of 38% silver diamine fluoride with or without potassium iodide in indirect pulp capping of young permanent molars. *JADA* 2022;153(12):1121-1133

116

## Is SDF Better than Fluoride Varnish?

- ▶ Semiannual topical application of silver diamine fluoride or sodium fluoride was no more effective than a placebo in preventing children from developing approximal caries.
  - ▶ 18 month study
  - ▶ High risk school aged children
  - ▶ Strategies to improve outcome include diet control, F- tp, water fluoridation
  - ▶ Sirivichayakul P et al: **The effectiveness of topical fluoride agents on preventing development of approximal caries in primary teeth: a randomized clinical trial.** *BMC Oral Health* 2023; 23:349.

117

## Atraumatic Restorative Technique

- ▶ Hand removal of caries and placement of high viscosity glass ionomer
- ▶ Cochrane Reviews
  - ▶ **Atraumatic restorative treatment (hand instruments only) compared with conventional treatment for managing tooth decay**
    - ▶ 28 December 2017
    - ▶ 15 studies with 3740 participants (2 had financial bias)
    - ▶ 4 ongoing studies
    - ▶ Quality of evidence
      - ▶ "The available evidence is low- to very low-quality"
    - ▶ Conclusion:
      - ▶ Low-quality evidence suggests that ART using H-GIC may have a higher risk of restoration failure than conventional treatment for caries lesions in primary teeth (using the same material)
      - ▶ Need to establish a noncalculus layer of enamel dentin for chemical bonding of GI



118

## SMART Technique

- ▶ Silver Modified Atraumatic Restorative Technique
- ▶ "No Needle, No Drill"
- ▶ "Atraumatic"
- ▶ SDF with GI placed over in ONE visit
- ▶ No substantial research to support
- ▶ Failures attributed to subjective selection criteria



119

## Hall Technique

- ▶ Without prepping, placing ortho separators, cement a SSC with GI cement over existing caries
- ▶ A comparison of 3 treatment modalities
  - ▶ traditional approach: numbing the tooth with injections, removing dental decay with drills and putting a filling in the cavity. This was accompanied with preventative treatment: the dental or dental hygienist delivering toothbrushing and diet advice as well as applying high-fluoride varnish.
  - ▶ Hall technique or placing a filling over decay without injections [ART]. This, too, was accompanied by preventative treatments.
  - ▶ preventative treatment alone.
- ▶ After three years, there was no evidence of a difference between the groups for pain, infection, quality of life or dental anxiety. **[NO DISCUSSION OF PERIODONTAL DISEASE, RECURRENT CARIES, HYPEROCCLUSION or FUNCTION]**
- ▶ **Nicola Innes** Professor of Paediatric Dentistry, **Mark Robertson** Clinical Lecturer in Paediatric Dentistry, University of Dundee
  - ▶ <https://theconversation.com/tooth-decay-in-children-is-it-time-to-put-the-needle-and-drill-away?id=1wAR104UeChm1j3jTn60Bk4Hyy93NAlscuH9j?atmf9f>



120

## Hall Technique

Table 1

Indications and contraindications for caries primary molars.

Indications of the Hall Technique
1. Tooth with carious crown, non-carious root (if the patient is unable to accept fluorine-released, partial crown, metal or conventional restorations) [1]
2. Tooth with proximal caries either untreated or non-carious if the patient is unable to accept partial crown, metal, or conventional restorations [1]
3. Hall technique is usually indicated to be used on non-restorable deciduous teeth [1]
Contraindications of the Hall Technique
1. Tooth with signs of pulpitis or dental infection or periodontal pathology [1]
2. Crown severely fractured with loose, which could not be removed [1]
3. Very young children who do not understand the procedure or who are taking the crown with its greatest interdental contact [1]

Table 2

Advantages of the Hall Technique for managing caries primary molars.

Advantages of the Hall Technique
1. It is an non-invasive procedure in which the crown is restored without local anesthesia, caries medication, or tooth preparation [1]
2. It is a quick procedure that does not require X-rays [1]
3. It is considered as a less invasive technique for the child [1]
4. It leads to caries arrest and could arrest caries at 4 best days 4 times [1]
5. It improves patient health [1]
6. It improves the success of dental care, decreases percentages of untreated dental caries and delays a restoration that will prevent caries with antibiotics [1]
7. It is more cost-effective than conventional restorations [1, 2]
8. If done at a single visit, the time needed to complete the procedure is reduced [1]

Philip W. Atkinson, David A. H. Stevenson. Hall Technique for Caries Primary Molars: A Review of the Literature *Quintessence* 2000; 29(1): 11.

121

## Resin Infiltrator: ICON by DMG

- Indicated for white spot lesions
  - Dysplasia/hypomineralisation from trauma, infection/fevers
  - Incipient carious lesions up to D1
  - Proximal and smooth surface lesions
- Studies show that caries do not progress for at least 18 mo following application
- Outcomes depend on depth of initial lesion
  - Resin infiltration up to 414 microns
- Technique
  - Polish enamel to open pores, etch with 15% HCl, dry with ethanol, infiltrate with TEGDMA (triethylene glycol dimethacrylate) X2

122

## Bioclear- new, really???

- Sectional matrices to rebuild teeth/ reduce black triangles
- Variations have existed for years under different tradenames
  - 3M Global: anterior and posterior pedo and adult strip crowns
  - 3M: strip crown forms
  - And others
- Allow a composite buildup for anterior or posterior without "freehanding" the restoration



123

## GI v RMGI v Composites

- Chemical composition
  - GI: polyacrylic acid and fluorosilicate/glass dispersed by HF
  - Composites: resin based matrix with a filler and photoinitiator
    - IPA (bisphenol A) v Bis GMA (bisphenol A-glycidyl methacrylate) or other dimethacrylate molecules
- Structure
- Bonding
  - Chemical v mechanical
- Wear resistance
- Shear strength
- Pulp response
- Release
- GI does not promote biofilm growth

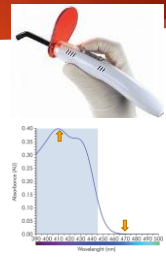


El Wakeel AM, Elkassas DW, Youny MMA. Bonding of contemporary glass ionomer cements to different tooth substrates: microtensile bond strength and scanning electron microscope study. Eur J Dent. 2015;9(2):174-182. doi:10.4103/1305-7454.154799

124

## How They Cure

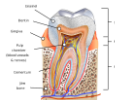
- GI
  - Chemical
  - Accelerated by heat from light "command cure"
    - Increases strength
- RMGI (nano)
  - Dual
    - Depth issue
    - Shrinkage
- RBC
  - Light
    - Depth
    - Material draws towards light as it polymerizes
    - Shrinkage



125

## And while we're on handpieces (and light curing), what's the effect on pulps?

- How does water spray affect pulp temperature?
  - Necrosis at  $\Delta 5.5$  C
  - High speed handpiece with water spray  $\Delta 3.9$  C
  - High speed handpiece without water spray exceeded  $\Delta 11.4$  C-  $19.3$  C
  - Thermal Effects on Pulp Due to Laser and Handpiece Usage, Clinical studies, Convergent Dental, Kugel et al, Nov 21, 2014.
  - Ozturk B. In vitro assessment of temperature change in the pulp chamber during cavity preparation. *The Journal of Prosthetic Dentistry* Volume 91, Issue 3, May 2004, Pages 436-440
- How does light cure affect pulp temperature?
  - Zarpelon DC et al. Influence of Class V preparation on in vivo temperature rise in anesthetized human pulp during exposure to a Polywave®LED light curing unit. *Dental Materials* 34(2018)90-909
  - "In vivo exposure of deep Class V preparation to Polywave®LED LCU increases PT to values considered safe for the pulp. For most BVE, Only the longest evaluated EM caused higher PT increase than the critical  $\Delta 1$ , thought to be associated with pulpal necrosis."



126

## Command Set

- Externally applied applications to promote curing
- Accelerating cure times and increasing GI strength
  - Ultrasonic stimulation
  - Heat
    - From light cure unit
    - Heating unit
  - Correlation between higher temperature and harder set
- Gareto K, Borzabadi-Farahani, A, Moshaverinia, A, Domagaj Glavina, Lynch E. Effect of different thermo-light polymerization on tensile strength of two glass ionomer cements and a glass carbomer cement. *J Prosthet Dent* 2017;118:102-107
- Kleverlaan CJ et al. Mechanical properties of glass ionomer cements affected by curing methods. *Dental Materials* (2004)20, 45-50

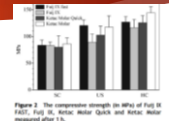
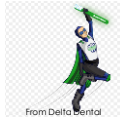


Figure 2. The compressive strength (in MPa) of Full II (FII). Full II, resin matrix (light and heat, resin measured after 1 h.

127

## Antibiofilm Activity

- ▶ GI>RMGI>RBC
- ▶ Fluoride is key
- ▶ GI Materials "Rechargable"
- ▶ Andrei Ionescu, Eugenio Brambilla, Sebastian Hahnelb, Does recharging dental restorative materials with fluoride influence biofilm formation? Dental Materials. 35(2019): 1450-1463



128

## Bioactive/Bioactivity

- ▶ ??????????????
- ▶ Marketing not scientific
  - ▶ Adopted for stimulated dentin deposition
- ▶ ISO has nothing for it!
  - ▶ ISO 9000 not at all related and is expired



129

## Use a mouth prop

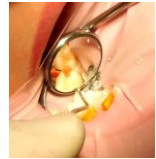
- ▶ The always useful mouth pillow!
- ▶ Helps the child relax
- ▶ Prevents unwanted "Code Red"
- ▶ Passive placement, not forced
- ▶ Isolation devices



130

## Don't extend for prevention

- ▶ G.V. Black had it all wrong!
- ▶ Small **bonded** restorations that preserve tooth structure
- ▶ Seal all vulnerable grooves
- ▶ Composite v. GI v RMGI
  - ▶ Wear resistance and acid dissolution
  - ▶ May need to cover GI and RMGI with composite



131

## Use Metal Matrices

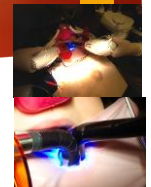
- ▶ Not plastic
  - ▶ Will have uncured layer of resin (BPA) next to the band
  - ▶ Another disagreement
- ▶ Increases reflected light
- ▶ Recent research says use plastic
- ▶ Obviously more research needed



132

## Use two curing lights

- ▶ Faster/Faster/Faster!
- ▶ Check to make sure your lights are biphasic (2 different frequencies)
- ▶ More light & multiple cure directions
  - ▶ Material shrinks toward light
  - ▶ Perpendicular to prep
- ▶ Still the most reliable at 40sec.
- ▶ Always use large tip
- ▶ Must get 70% cure rate for maximum strength
- ▶ Or just buy a brighter light...
  - ▶ Does not lead to increased shrinkage
  - ▶ Cure in 5-9 seconds
  - ▶ >1200 lumens
- ▶ Check material compatibility-2 phase
  - ▶ Check wavelength in nm.



133

## Other Composite Op Tips!

- Place a flowable material in the proximal box and then pack your composite into it:
  - allows better adaptation and a little more resiliency at the margins
  - slow glow
- Use a burnisher (not a plugger) to place and smooth composites
- Opaque/whiter materials need more light
  - Bulk fill composites cure more thoroughly but most wear more rapidly
  - 10-30 seconds and perpendicular
- Trim using 12 fluted carbide flame and barrel shaped burs and a gingival trimmer
- When restoring a pulpomatized tooth, separate eugenol or silicone based materials from the composite by placing a layer of glass ionomer
- Advice on the bruxer/GERD/MIS child!
  - The teeth flex and the composite is stiff
  - GI will give but also erode
  - Place orthodontic band and cement with GI cement



134

## Stainless Steel Crown against Composite



135

## Crown Rule #1

- ▶ **You fit the tooth to the crown not the crown to fit the tooth**
- ▶ **Even more so for cosmetic/zirconia crowns**

136

## Anterior and Posterior Esthetic (and not!) Restorations

- ▶ Composite
- ▶ Stainless Steel Crowns
- ▶ Stainless Steel Crowns with composite windows
- ▶ Stainless Steel Crowns powder coated in white
- ▶ Stainless Steel Crowns with bonded acrylic or composite
- ▶ Strip crown or Pedaform full coverage composite crowns
- ▶ Preformed composite crowns/ polycarbonate crowns
- ▶ Silicate preformed crowns
- ▶ Ceramic Crowns (Sprig/EZPeda, NuSmile)

137

## Anterior Esthetic Restorations



138

## Stainless Steel Anterior Crowns with Composite Facings



<http://www.dentalcare.com/en-US/dental-education/continuing-education/>

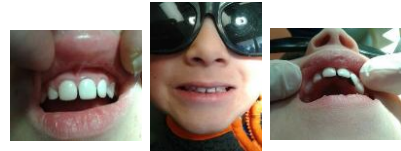
139

## Resin Bonded Stainless Steel Crowns



140

## Resin Bonded Stainless Steel Crowns



141

## Zirconia Presized Crowns

- ▶ Sprig
- ▶ NuSmile
- ▶ Cheng



142

## Composite Strip Crowns

Also work with RMGI and GI!  
Better margins than preformed crowns



143

## Posterior Composite Crown

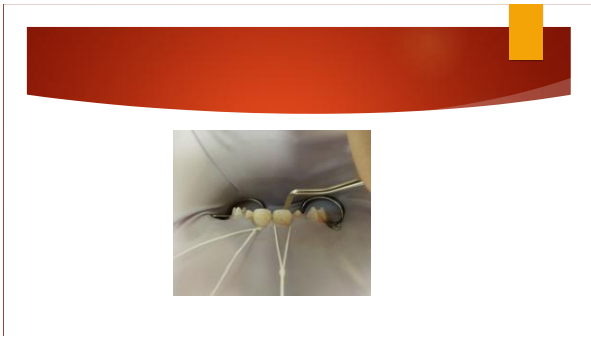


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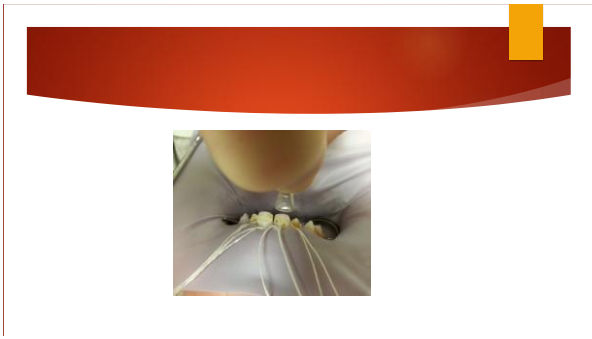


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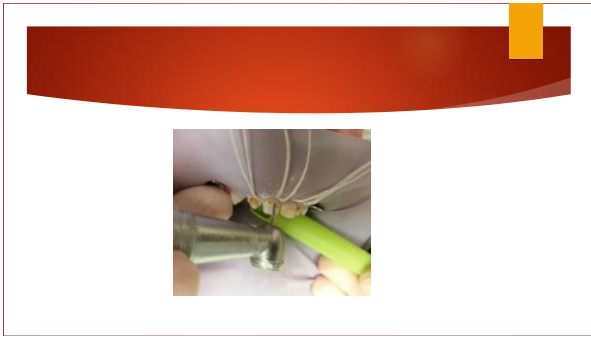




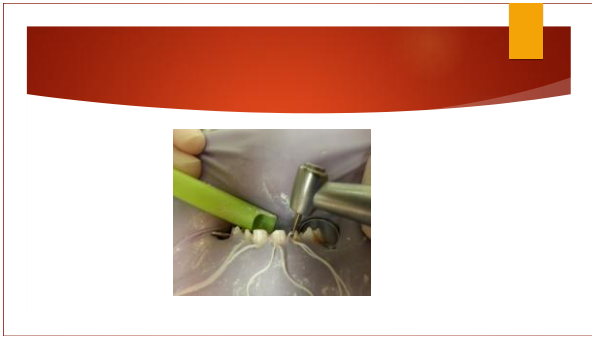
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147



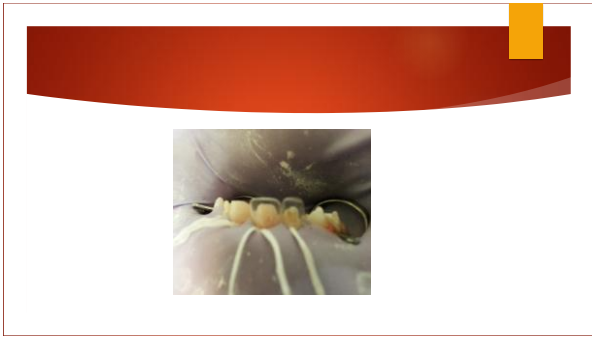
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149



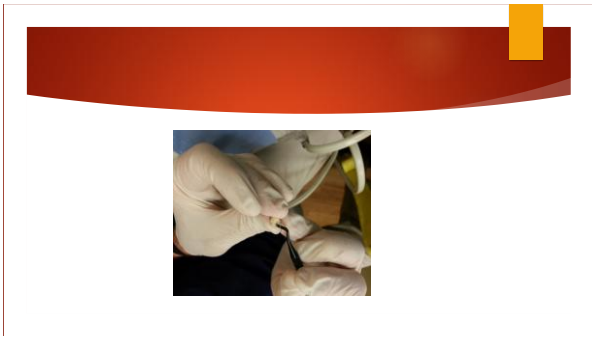
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151



152



153



154



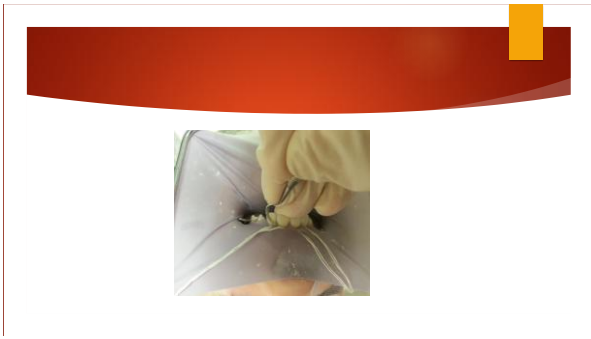
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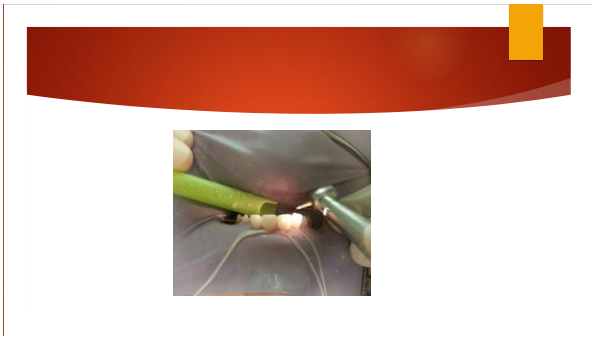
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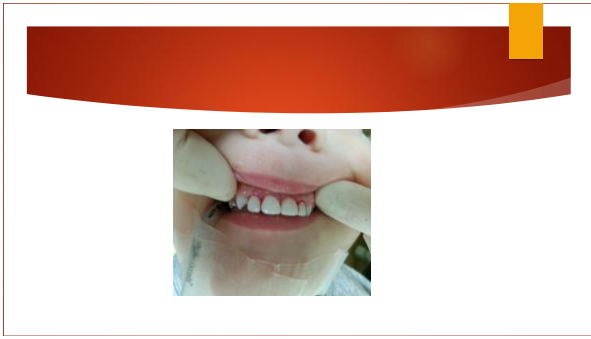
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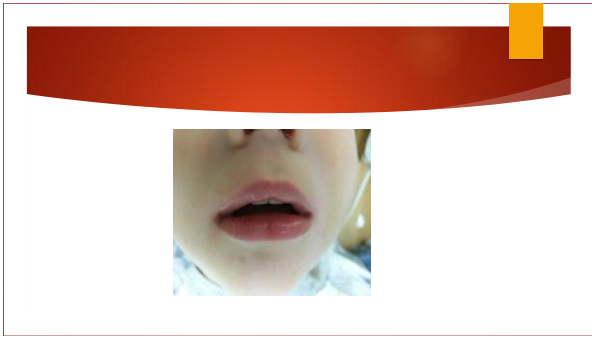
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159



160



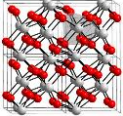
161



162

### Zirconia Crowns

- ▶ Zirconium dioxide  $ZrO_2$ 
  - ▶ Ceramic metal
  - ▶ Monoclinic crystal structure becomes a stabilized tetragonal structure and with stress becomes a more stable monoclinic
  - ▶ Essentially chemically unreactive
  - ▶ Inflexible
  - ▶ Wear resistant
  - ▶ No bonding abilities



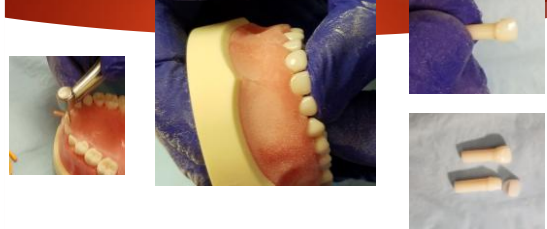
163

## Zirconia Crown Preps

- ▶ Principles
  - ▶ Zirconia doesn't flex
    - ▶ Light occlusal forces
  - ▶ Can't be trimmed
  - ▶ Retention is by parallel walls to minimize cement (GI) interface
  - ▶ Prep must go 2 mm below gingiva ridge
  - ▶ Prep must not have any ledges
  - ▶ Hemorrhage control a must
    - ▶ Hemostatic agent
    - ▶ Overfill crown to force gingiva and blood out of the way
  - ▶ +/- Pulpotomy

164

## Socks on a Rooster



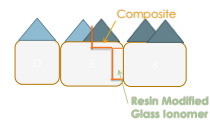
165



166

## Modified Posterior Sandwich Restorations in Primary Teeth

- ▶ Sandwich Preparation
  - ▶ Fluoride releasing G.I. next to incipient lesion covered by wear resistant composite
  - ▶ Very low amount
  - ▶ Appropriate on proximal lesions in primary teeth
  - ▶ Extremely appropriate on distal lesions on 2<sup>nd</sup> primary molars abutting a permanent molar



167

## Molar Incisor Hypomineralization MIH

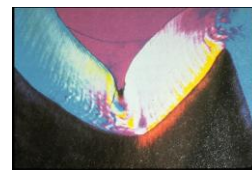
- ▶ Painful and difficult to treat
  - ▶ Poor bonding/immature dentin and enamel
- ▶ Technique 1
  - ▶ Apply SDF X 3 at weekly intervals
  - ▶ RMGI or GI
- ▶ Technique 2
  - ▶ Orthodontic band filled with GI then cover occlusal surface for
  - ▶ Half type crown coverage filled with GI cement
- ▶ Technique 3
  - ▶ Extraction at 9-10 per criteria
  - ▶ Substitution by 2<sup>nd</sup> molar with limited orthodontics



By Unknown Author's  
licensed under

168

## And How About Sealants?



▶ Thanks Dr. Buonocore!

169

## Reasons for Initial Caries in the Occlusal

- ▶ Mineralization defects
- ▶ Fissure morphology
- ▶ Lack of self cleansing
- ▶ Inability of mechanical cleansing



170

## Indications

- ▶ Pit and fissures in molars and premolars
- ▶ Primary and permanent teeth
- ▶ Linguals on anteriors
- ▶ Geminated or fused teeth



171

## Sealing Systems Currently Available

- ▶ Resin based bonded sealants without fluoride
- ▶ Resin based bonded systems with fluoride release
- ▶ Self-etching resin systems
- ▶ Glass ionomer systems
- ▶ Flowable composite over bond
  - ▶ Low fill: more shrinkage and leakage
  - ▶ High fill: less shrinkage
- ▶ Needed: ion flow system with remin. capabilities!

172

## Flash: GI Sealant Systems Useful ?

- ▶ Resin seals:
  - ▶ Higher retention rate with grooving
  - ▶ 32% loss at 2 years
- ▶ GI seals
  - ▶ Higher retention rate without grooving
  - ▶ 60% loss at 2 years
- ▶ Caries rates at 2 years
  - ▶ Resin
    - ▶ With grooving 14%
    - ▶ Without grooving 12%
  - ▶ GI
    - ▶ With grooving 4%
    - ▶ Without grooving 8%
- ▶ *Pediatr Dent* 2012; 34: pp46-50



173

## Sealants Fail Because...

- ▶ Overetching
- ▶ Decay in grooves
- ▶ Moisture and other contaminants in grooves or on surface
- ▶ Air bubbles or pockets
- ▶ Dislodgement from occlusion
- ▶ No ion transfer prevents remineralization

174

## Pulp Therapy



175

## Pulp Therapy Primary Tooth



176

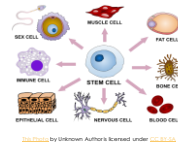
## New Concepts in Dental Pulp Therapy

- ▶ Indirect and Direct Pulp Capping instead of pulpotomy or pulpectomy
  - ▶ Formation of reparative dentin
    - ▶ CaOH<sub>2</sub>
      - ▶ Facial necrosis/ cytotoxic
      - ▶ Poor setting and degradation overtime
      - ▶ Voids underneath
    - ▶ MTA/NeomTA/Biodentine
      - ▶ Portland cement
      - ▶ Anticorrosive
      - ▶ Higher cytotoxicity when healthy mixed/ heavy metals
      - ▶ Long setting time
  - ▶ "Bioactive" Glasses (GIR/RMG)
    - ▶ Stable pH
    - ▶ Promote hydroxyapatite
    - ▶ No cytotoxicity just irritation

177

## Dentin Pulp Complex Regeneration after Pulpotomy (vital tooth)

- ▶ Standard Pulpotomy
  - ▶ Amputate pulp
  - ▶ Build dentin bridge with CaOH<sub>2</sub>
  - ▶ Does not regenerate tissue
- ▶ Future Pulpotomy
  - ▶ Induction of stem cells
  - ▶ Induction of capillary networks
  - ▶ Growth factor delivery system
    - ▶ FGF-2 in a gelatin hydrogel
      - ▶ Add BMP-2 for strength with PRP and growth factor
  - ▶ Scaffolds for cell proliferation and differentiation
    - ▶ Chitosan, gelatin
    - ▶ Synthetic poly(methacrylate) (PGA) and PLG
    - ▶ Hyaluronic acid/HLA scaffold + anti-inflammatory



178

## Primary Tooth Pulp Therapy

- ▶ Caries Control
- ▶ Pulpotomy
- ▶ Pulpectomy
- ▶ Extraction

179

## Primary Tooth Pulp Therapy

- ▶ Caries Control
  - ▶ Active decay
  - ▶ Elicited pain
  - ▶ Absence of soft tissue findings
  - ▶ Absence of radiographic findings
  - ▶ Absence of mobility

180

## Primary Tooth Pulp Therapy

- ▶ Caries Control/ Indirect Pulp Cap
  - ▶ Partial removal of decay
  - ▶ Partially and hydroscopic material
  - ▶ ZOE RM
  - ▶ Ca(OH)<sub>2</sub>
    - ▶ Light cured Theracal
  - ▶ MTA/Biodentine/NeomTA
  - ▶ Glass ionomers
  - ▶ Return for definitive pulp therapy and restoration (sometimes Not always)
- ▶ Direct Pulp Cap
  - ▶ Rarely effective
  - ▶ MTA/Biodentine
  - ▶ Z Theracal
- ▶ Hilton TJ. Keys to Clinical Success with Pulp Capping: A Review of the Literature. Oper Dent. 2009 ; 34(5): 615-625.



181

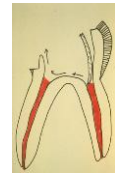
## Pulp Therapy Rule #1

- ▶ **The pulp chamber in primary teeth is always in the middle of the occlusal surface**

182

## Primary Tooth Pulp Therapy

- ▶ Pulpotomy
  - ▶ Active decay
  - ▶ Elicited or spontaneous pain
  - ▶ Absence of soft tissue findings
  - ▶ Absence of radiographic findings
  - ▶ Absence of mobility
  - ▶ Controllably hemorrhagic pulp\*
  - ▶ Infected coronal and radicular pulp



183

## Pulpotomy Medicaments

- ▶ Ca(OH)<sub>2</sub>
  - ▶ High alkalinity
  - ▶ Bacteriocidal
  - ▶ Superficial necrosis of pulp and tissues it touches
  - ▶ Induces growth factors
- ▶ Vitapex
- ▶ MTA
  - ▶ Significantly better medicament 6 and 12 months out
- ▶ Acid base issues with glass ionomers/Ca(OH)<sub>2</sub>/MTA and derivatives
- ▶ Settling issues with moisture from MTA and RBC
- ▶ Review article:
  - ▶ Taneja S, Singh A: Evaluation of effectiveness of calcium hydroxide and MTA as pulpotomy agents in permanent teeth: a meta-analysis. *Pediatr Dent J* 29:90-96, 2019.

184

## Vitapex

- One word for successful pulpotomies and pulpectomies
- Calcium hydroxide
- Silicone oil\*
  - Prevents restorative bonding
- Iodophor paste
  - Iodamethane-potentially toxic
  - antibacterial
- Wonder drug?
  - Are the results clinically better?
  - ▶ Morfrazavi M, Mesbahi M. Comparison of zinc oxide and eugenol and Vitapex for root canal treatment of necrotic primary teeth. *Int J Paediatr Dent*. 2004 Nov; 4(6):417-24.



185

## Mineral Trioxide Aggregate



- ▶ MTA is a cement (Portland Cement) composed of tricalcium silicate, dicalcium silicate, tricalcium aluminate, tetracalcium aluminoferrite, calcium sulfate and bismuth oxide (modify setting properties)
- ▶ Alkaline similar to calcium hydroxide explaining properties
- ▶ Antibacterial
- ▶ Mix powder with sterile water and pack into area with condenser or tool. Area should be moist to aid setting
- ▶ 4 hour set
- ▶ Use under SSC or GI then cover with composite
  - ▶ Uncured layer- acid/base
- ▶ Strength equal to IRM, seals better than amalgam
- ▶ Histologically induces dentinogenesis and cementogenesis with little inflammatory response
  - ▶ Cytokine release and interleukin production
- ▶ Nonresorbable
- ▶ Expensive as a dental material, cheap as Portland cement

186

## Two Basic Formulations

- ▶ ProRoot by Dentsply Tulsa
  - ▶ MTA
  - ▶ Changes tooth color
  - ▶ Requires lining coronal section with bonding agent to block dentinal tubules
- ▶ Biodentine by Septodont, NeoMTA
  - ▶ Tricalcium Silicate
  - ▶ Color stable
  - ▶ Approved by FDA for pulpotomies
  - ▶ Can place composite directly over without flex after 15-30 minutes
  - ▶ GI/RMGI Uncured layer because of acid/base reactive



187

## Achieving Hemostasis

- Slightly moist cotton pellet and pressure
- Cotton pellet dipped in fibrin
- Electrosurgery/electrofulguration
- Cotton pellet dipped in astringent
  - Ferric sulfate
    - Astringent
  - Ferric chloride
  - Aluminum chloride
  - Hemodent
- Gels
  - Aluminum chloride
  - Raccadent thermogel (Septodont)
  - Resodent (premax)
    - Absorbs moisture and contracts vessels



- Do we need hemostasis?
  - Muller, M., Askanav, S., Kaya, H. Does Achievement of Hemostasis After Pulp Exposure Provide an Accurate Assessment of Pulp Inflammation? *Pediatr Dent*. 2018; Jan 1;40(1):37-42.

188

## Primary Tooth Pulp Therapy

- Mycobacterium abscessus* facial cellulitis
  - 30+ children in Atlanta
  - 71+ children in Anaheim
- Hospitalized following pulpotomy procedures
  - Multiple antibiotics
- MA normal bacterium in water lines
  - Is it a dental hazard?
  - Ferric sulfate for hemostasis?
- Water line cleanliness
  - Use only sterile water
  - Filters
    - Steel
    - Remove biofilm
    - Backwash
- Irrigants
  - "Cleaned water"
  - Chemicals

### *Mycobacterium abscessus* Infections Among Patients of a Pediatric Dentistry Practice — Georgia, 2015

- CDC Report: Glavina-Pearls, MPH1, 2; Melliss, Tobiya D, MD1, 2; Anglin-Peterson, DVM1, 3; Davis, Elisha, DVM1, 4; Luchini, Catherine, MPH1; Carol Smith, MSMA1; Cherie Drenski, DVM1



189

## Anti-Bacterial Effects of Biodentine

Zone of inhibition	Biodentine	MTA	GIC
<i>Streptococcus mutans</i>	3.8	2.6	3.1
<i>Enterococcus faecalis</i>	3.1	2.6	1.6
<i>Escherichia coli</i>	2.9	3.8	1.4
<i>Candida albicans</i>	2.9	2.2	0.9
Mean	3.175	2.3	1.75
SD	0.42	0.38	0.94
Intra P-value	0.748	0.842	0.034

Inter P-value = 0.032, SD: Standard deviation, MTA: Mineral trioxide aggregate, GIC: Glass ionomer cement

**Conclusion: Growth inhibition zones with Biodentine are higher than with MTA or GIC.**

Bhavana V et al, *J Conserv Dent*. 2015

190

## Irrigating and Cleansing Solutions

- NaClO
  - Antibacterial
  - Disables organic material
  - No effect on dentin walls
  - Does not remove smear layer
  - Periapical damage to forming teeth and soft tissues
- Chlorhexidine 2%
  - Polant antibiotic agent germ-neg-
  - Affected by pH
    - Inhibits
    - Cannot dissolve organic tissues or smear layer
    - Can form polychlorhexidene in presence of NaOCl (a carcinogen)
- Ethylenediaminetetraacetic Acid (EDTA 17%)
  - No antibacterial activity**
  - Highly biocompatible
  - Dememineralize intratubular dentin and reduce hardness of EC wall dentin
  - Alternate with NaClO



191

## Primary Tooth Pulp Therapy

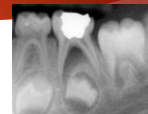
- Why pulpotomies fail...
  - Define FAILURE!
    - Failure to remove entire roof of pulp chamber
    - Failure to remove all coronal pulp and pulp tags
    - Failure to achieve hemostasis not key!
      - Merve Muller, Volkan Arkan, Saziye San, Cicer Koca. Does Achievement of Hemostasis After Pulp Exposure Provide an Accurate Assessment of Pulp Inflammation? *Pediatr Dent* 2018; Jan 1;40(1): 37-42.
  - Failure in diagnosis
    - necrotic pulp
    - infected and hemorrhagic pulp
  - Failure to maintain clean field/ place appropriate nonleaking restoration



192

## Primary Tooth Pulp Therapy

- Pulpectomy
  - Necrotic pulp
  - Key, space maintaining tooth
  - +/- soft tissue findings
  - +/- radiographic findings
  - No potential damage to forming tooth
  - +/- pain



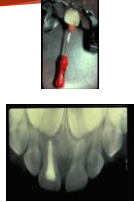
193



## Primary Tooth Pulp Therapy

### ▶ Pulpectomy

- ▶ Access same as pulpotomy
- ▶ Remove ALL pulp tissue in canals
- ▶ Irrigate with peroxide/bleach/chlorhexidine
- ▶ Achieve dry canals
- ▶ Obturate with ZOE/Vitapex ONLY!
  - ▶ Resorbable
  - ▶ Cover with GI
- ▶ Full coverage or partial/access restoration



194

## Primary Tooth Pulp Therapy

### ▶ Pulpectomy

- ▶ Lesion Sterilization and Tissue Repair (LSTR) AKA Non-Instrumental Endodontic Treatment (NIET)
  - ▶ Niigata University, Japan, 1988
  - ▶ Triple antibiotic: Ciprofloxacin, Metronidazole, Minocycline in propylene glycol paste
  - ▶ Placed in teeth with necrotic pulps without instrumenting, sealed with GIC, final restoration placed
- ▶ Problems
  - ▶ Exposure and sensitivity
  - ▶ Overuse of antibiotics and resistance as well as emergence of other bacteria
  - ▶ Systemic toxicity and side-effects on GI and tendons/joints
- ▶ Efficacy
  - ▶ No greater than standard pulpectomy techniques
  - ▶ Duarte, M.L., Pires, P.M., Ferreira, D.M., et al. Is there evidence for the use of lesion sterilization and tissue repair therapy in the endodontic treatment of primary teeth? A systematic review and meta-analysis. *Clin Oral Invest* 24, 2939–2972 (2020). <https://doi.org/10.1007/s00784-020-03415-0>



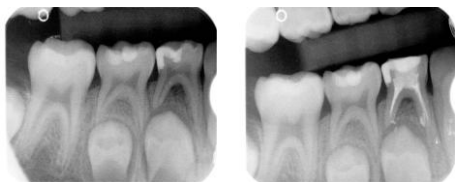
195



196



197



198

## Restoring the Pulp Treated Tooth



199

## And finally, if you can't get a crown to fit...

- ▶ Turn the beiling pliers backwards and reverse bell!
- ▶ Use maxillary opposite side molar for mandibular space loss



200

## Primary Tooth Pulp Therapy v. Extraction

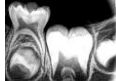
- ▶ Extraction
  - ▶ critical: may require space maintenance
  - ▶ noncritical: optional cosmesis



201

## Primary Tooth Pulp Therapy v. Extraction

- ▶ 3 simple rules
  - ▶ Good anesthesia
  - ▶ Be gentle and slow
  - ▶ Section the bow-legged roots
    - ▶ Mandibular: M-8 in middle
    - ▶ Maxillary: in 3: MB, DB, Palatal



202

## Extraction Alternative: Pedi Bridge



203

## Space Maintenance

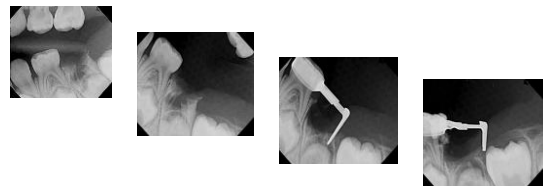
- ▶ Unilateral
  - ▶ Band and loop
  - ▶ Gerber (SML)
  - ▶ One armed Bandit
- ▶ Bilateral
  - ▶ Mandibular
    - ▶ LLHA
  - ▶ Maxillary
    - ▶ TPA
    - ▶ Nance



204

## Space Maintenance

- ▶ Distal Shoe



205

## Purpose of the Primary Dentition

- ▶ Speech
- ▶ Mastication
- ▶ Esthetics
- ▶ Prevention of Oral Habits (tongue thrust)
- ▶ Guiding the Erupting Permanent Teeth
- ▶ Maintain Arch Integrity and Arch Length

206

## Disruption of Dental Arch in Primary Dentition

- ▶ Reduction of arch length
- ▶ Blocked or deflected eruption of permanent teeth
- ▶ Supereruption of opposing dentition
- ▶ Interferences in occlusion
- ▶ Unattractive appearance
- ▶ Food impaction
- ▶ Increased caries and periodontal disease

207

## Purpose of Space Management

- ▶ Maintain mesiodistal relationship
- ▶ Prevent space loss
- ▶ Prevent ectopic eruption
- ▶ Reduce need for further orthodontic management

208

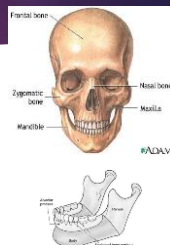
## Prevention is Key to Success and Health

- ▶ Diet and Caries
- ▶ Frequency of eating
- ▶ Oral hygiene and removal of biofilm
  - ▶ Brushing
  - ▶ Flossing
- ▶ Fluoride use
  - ▶ At least BID for tp
  - ▶ Continuous for tap H<sub>2</sub>O
- ▶ Sugar Alcohols
- ▶ Frequent dental visits
  - ▶ Why twice per year

209

## All Bone is not the Same!

- ▶ Skeletal or basal bone
  - ▶ Intramembraneous or Endochondral
  - ▶ Thick cortical plate
  - ▶ Vascular with marrow spaces
  - ▶ Unrelating
- ▶ Alveolar bone
  - ▶ Develops embryologically with cementum
  - ▶ Von Koff's fibers
  - ▶ Exists only for the teeth
  - ▶ Porous
  - ▶ Allows orthodontic movement through rapid remodeling
    - ▶ ARF cycle



210

## Mechanisms of Tooth Eruption

- ▶ Root Formation
  - ▶ Hertwig's epithelial root sheath and basement membrane
- ▶ Bone Remodeling
  - ▶ Moves teeth through growth and selective resorption and deposition
  - ▶ ARF cycle
- ▶ Dental Follicle
  - ▶ Cascade of intracellular signals that recruit osteoclasts and decrease blood supply
- ▶ PDL
  - ▶ Stem cells
- ▶ Molecular determinants of tooth eruption
  - ▶ Balance between destruction and depositional bone

211

## Eruption of Permanent Teeth

### ▶ Process

- ▶ Primary tooth resorbs independently of perm tooth
- ▶ Root of permanent tooth lengthens against Hertwig's Epl Root Sheath
- ▶ Permanent tooth develops path and moves through bone by apoptosis and hormonal intervention
- ▶ Alveolar process increases in height
  - ▶ Alveolar bone is directly connected to dentin/cementum through von Karff's fibers



### ▶ Stages

- ▶ Pre-Emergent <2/3 root- in bone
- ▶ Post Emergent >2/3 root- out of bone

212

## Factors that Influence Space Loss

- ▶ Abnormal Musculature and imbalance
- ▶ Oral Habits
- ▶ Existing malocclusion and genetic factors
- ▶ Stages of occlusal development
  - ▶ Increased space loss if teeth are actively erupting adjacent to space left by early tooth loss

213

## Factors Reviewed Before Space Management

- ▶ Time elapsed since loss
  - ▶ Space maintenance sooner the better
- ▶ Dental age of patient
  - ▶ Which teeth have erupted-perm v prim
  - ▶ Development of permanent tooth
  - ▶ Root resorption of tooth being lost
- ▶ Amount of bone overlying unerupted tooth
  - ▶ Abscess and bone damage
  - ▶ Early eruption of perm tooth without 2/3 root development
- ▶ Sequence of eruption of permanent teeth
- ▶ Delayed development leading to delayed eruption and impaction of perm tooth
- ▶ Congenital absence of permanent tooth and orthodontic consultation with ridge preservation
- ▶ Growth pattern of the jaws: horizontal v vertical

214

## Space Loss by Arch

- ▶ Maxillary
  - ▶ Forward bodily movement
  - ▶ Mesial crown tipping
  - ▶ Mesiolingual rotation around the palatal root
- ▶ Mandibular
  - ▶ Mesial crown tipping of teeth posterior to loss
  - ▶ Distal movement and retroclination of teeth anterior to space
  - ▶ No bodily movement
  - ▶ Greatly enhanced in vertical growers

215

## When Do You Need Space Management?

- ▶ Anterior after cuspid eruption
  - ▶ No
  - ▶ Cosmetics with Grasper appliance for maxillary arch
- ▶ Cuspids
  - ▶ Yes
    - ▶ To prevent midline deviation and space loss with lower incisors moving laterally into space
- ▶ Primary 1<sup>st</sup> molar
  - ▶ Mandibular
    - ▶ Yes
      - ▶ Unilateral or bilateral
  - ▶ Maxillary
    - ▶ Yes/no depending on whether first permanent molar present (discuss if rotational space closure)
    - ▶ Bilateral or unilateral
- ▶ Primary 2<sup>nd</sup> molar
  - ▶ Mandibular
    - ▶ 1<sup>st</sup> perm molar present - yes
    - ▶ 1<sup>st</sup> perm molar not present - modified distal shoe appliance
  - ▶ Maxillary
    - ▶ Yes - to prevent mesial tipping and rotation of 1<sup>st</sup> perm molar

216

## Characteristics of the Ideal Space Maintainer

- ▶ Prevent movement of teeth from anterior and posterior directions
- ▶ Not interfere with normal growth and development
- ▶ Simple to construct and maintain
- ▶ Durable, strong, stable and adaptable
- ▶ Passive placement except in space regaining
  - ▶ Halterman appliance and spring appliance
- ▶ Cleansible and adjustable

217

## DANGER WILL ROBINSON\*

- ▶ No sticky foods
  - ▶ Gum is usually OK
- ▶ Hard crunchy foods on the other side
- ▶ The child will likely dislodge one time within first month
  - ▶ Tell child to tell parents and gently remove before chewing on it
- ▶ May cause eruption and growth and development problems
- ▶ May increase caries and food retention therefore optimum OH

\* Obscure reference to old TV show, "Lost in Space"

218

## Types of Space Maintainers

- ▶ Fixed and Cemented
  - ▶ Band and loop and modified distal shoe
    - ▶ Unilateral space loss
    - ▶ Max and mand
    - ▶ One or two teeth
    - ▶ Allows eruption of permanent teeth
  - ▶ Lingual arch
    - ▶ Allows eruption of permanent teeth
    - ▶ Mandibular
    - ▶ May restrict buccal growth



219

## Types of Space Maintainers

- ▶ Nance Holding Arch
  - ▶ Maxillary
  - ▶ Bilateral with unilateral or bilateral space loss
  - ▶ Acrylic palatal button to prevent mesial migration
  - ▶ Prevents buccal expansion and single tooth eruption
- ▶ Transpalatal Arch
  - ▶ Maxillary
  - ▶ Bilateral with unilateral or bilateral space loss
  - ▶ Placed between most distally erupted teeth
  - ▶ Prevents buccal expansion and single tooth eruption

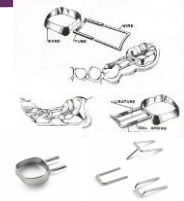


Wilson 3-D

220

## Types of Space Maintainers

- ▶ Chairside v Lab Processed
  - ▶ Time to placement
  - ▶ Cost
  - ▶ Flexibility
  - ▶ Customization
  - ▶ Tooth eruption
  - ▶ Impressions- accurate?
  - ▶ Hemostasis
  - ▶ Fit to gingiva
  - ▶ Erupting tooth?
- ▶ Chairside
  - ▶ Gerber
  - ▶ Wilson 3D



221

## Types of Space Maintainers

- ▶ Cosmetic
  - ▶ Groper Appliance
    - ▶ Can also function as space maintainer
    - ▶ Hint: place composite on linguals of cuspids to decrease torque on bands



222

## Types of Space Maintainers

- ▶ Removable
  - ▶ Require stability and therefore bulk and retention
  - ▶ Can be aspirated if poorly fit
  - ▶ Easily customizable for space regaining
  - ▶ Unilateral/Bilateral



Space regaining appliance

223

## Comparison of Fixed v Removable

Fixed Appliances	Advantages	Disadvantages
	Minimal patient cooperation to keep in mouth	Does not restore occlusal function
	More difficult to break or dislodge	Difficult to clean
	Manufactured chairside with fewer adjustments	Difficult to adjust after inserted
	May be placed immediately after extraction	Have to either impression before and remove tooth from cast or wait until tissue heals

224

## Comparison of Fixed v Removable

Removable Appliances	Advantages	Disadvantages
	Easily cleaned	Requires patient cooperation
	Easily adjusted	Soft tissue irritation
	Easily constructed usually by lab	Easily broken or lost
	Easily repaired	Requires impression and multiple visits
	Maintains occlusion	Plaque trap

225

## Alternatives to Restorative Care

- ▶ Parent wishes
- ▶ Exfoliation within 6-9 mo
  - ▶ Tooth is asymptomatic
  - ▶ Child is comfortable
  - ▶ No risk to surrounding teeth
  - ▶ Oral hygiene is maintained
  - ▶ Finances
- ▶ Palliative care
- ▶ Orthodontic treatment
  - ▶ Future planning for space management



226

## Friday 4:30 PM: What You'd Like to Say



227

And The Secret of  
Pediatric Dentistry Is  
Finally Revealed!

228



229

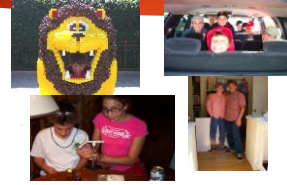
## Tips to Make It Through a Day

- ▶ Always give options but...
  - ▶ Never ask a question to which no is the unintended answer
- ▶ If a situation escalates to the point where you are getting uncomfortable...
  - ▶ Walk away for a few moments
- ▶ Always go home feeling good about what you've done and whom you've treated



230

## Enjoy yourself!



David L. Rothman MD 2019

231

## Thank You for Listening

- ▶ Any questions?



David L. Rothman MD 2019

232