A photograph of a golf green with a hole and a ball. The green is lush green, and the hole is visible on the left side. A yellow flag is in the hole. A white golf ball is on the green, near the hole. The background is a blurred green field.

Evidence-Based Pediatric Dentistry: A Synthesis of Behavioral and Restorative Components

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Goal of Pediatric Dentistry

- Maintain oral health of the child.
 - Healthy teeth and gums.
 - But also includes:
 - Cooperative behavior during appointments.
 - Positive self-image and self-control.
 - Positive oral health practices.
 - Positive opinion of oral health and oral health providers.
 - A desire to continue preventive dental appointments after reaching the age of maturity.

Learning Theory

- Conditioned Response
 - Pavlov's classic experiment
 - He struck a bell prior to when the dogs were fed. If the bell was sounded in close association with their meal, the dogs learned to associate the sound of the bell with food. After a while, at the mere sound of the bell they responded by drooling.
 - Same experiment was completed with a bell sound and an electric shock. After a certain threshold of sounding the bell and delivering a shock, the dogs learned to anticipate pain with the sound of the bell.

Learning Theory

- Conditioned Response
 - The same reaction is thought to occur with unpleasant medical and dental treatments.
 - If the person has a threshold level of poor experiences, they “learn” to associate visits to the practitioner with unpleasant consequences to that visit.
 - In adults, it leads to infrequent dental visits and poor appointment compliance. In children, this results in poor behavior.

Learning Theory

- Extinction
 - A therapy designed to “unlearn” the conditioned responses.
 - The stimulus is applied, but without the adverse consequence, and eventually the physiologic response to the stimulus is eliminated.
 - Requires significantly more occurrences than the original threshold to create the response.

Learning Theory

- Latent Inhibition Theory
 - This theory postulates that a stimulus provided with a neutral or positive consequence will result in a “learned” response that will be neutral or positive.
 - When a negative consequence then occurs with the stimulus, the “learned” neutral or positive response will overcome the memory of the occasional negative consequence, and the subject will still associate the neutral or positive response to the stimulus.

Learning Theory

- Ten Berge et al. The Etiology of Childhood Dental Fear: The Role of Dental and Conditioning Experiences. *J Anxiety Disorders* 2002;16:321-29.
 - Temperamental factors (Shyness, general fearfulness) associated with fear as well as direct conditioning.

Learning Theory

- Ten Berge et al. (con't)
 - Low-fearful children were found to have experienced more check-up visits before they underwent their first curative treatment than were the fearful children.
 - Indicates that children with a longer history of non-invasive visits are less likely to develop high dental fear than children who have experienced invasive treatments earlier in their dental history.

Learning Theory

- Ten Berge et al. (con't)
 - Overall, the number of restorations or extractions had a mild to moderate effect on children's fears.
 - The emotional nature of a dental visit may be of decisive influence in the acquisition of dental fear.
 - That is, the child's subjective perception of a dental visit may be more decisive in the acquisition of dental fear.

Learning Theory

- Ten Berge et al. (con't)
 - Most important etiological factors of dental fear in children are:
 - Number of traumatic visits.
 - Perceived lack of dentist's empathy.
 - Child's general fearfulness.
 - Parental fear.

Learning Theory

- Ten Berge et al. (con't)
 - The fear eliciting effect of painful treatment may be mediated by the dentist's behavior.
 - Pain inflicted by a dentist perceived as “caring” has a less negative impact than pain inflicted by a “cold” or “uncaring” dentist.

Learning Theory

- Ten Berge et al. (con't)
 - The acquisition of dental fear seems less likely after a history of non-invasive visits.
 - The acquisition of dental fear may be prevented by having children visit the dentist regularly from a very young age.

Achieving My Goals

- How can I deliver care in a manner that will result in meeting not just the primary goal of oral health, but also the secondary goals of a positive attitude towards dentistry and oral health?



Achieving My Goals

- Historical Methods
 - Behavior management techniques ranging from the simple (Tell-Show-Do) to the advanced (adverse behavior management techniques, sedation, general anesthesia).
 - Advances in pain control (“painless” local anesthesia delivery, profound pulpal anesthesia)

Current Caries Management Research

- What does the current literature have to provide to the achievement of my goal?
 - Best summarized as Minimally Invasive Care.
 - Fighting the disease, not the lesion.
 - Intervention during the caries process to reverse or arrest disease progression.
 - Take advantage of the pulp-dentin complex reactions to the advancing carious lesion to reduce the need for local anesthesia.

Current Caries Management Research

- “The complete divorcement of dental practice from studies of the pathology of dental caries, that existed in the past, is an anomaly in science that should not continue. It has the apparent tendency to make dentists mechanics only.”

G. V. Black, 1908

Operative Dentistry, Volume 1 Pathology of the Hard Tissues of the Teeth. Chicago: Medico-Dental Publishing Company, 1908

What is the Disease?

- Dental Caries

- The progressive loss of tooth mineral structure as the result of oral bacteria-generated acids.
- This is the disease.

- Dental Cavity

- The physical breakdown of tooth structure as a result of the caries process.
- This is the result (signs/symptoms) of the disease.

What is the Disease?

- Caries Process Review
- Types of apatite
 - Carbonated apatite (CAP)
 - Major type found
 - $\text{Ca}_{10}(\text{PO}_4)_6\text{CO}_3$
 - Hydroxyapatite (HAP)
 - $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$
 - Fluorapatite (FAP)
 - $\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2$

What is the Disease?

- Caries Process Review
 - Acid solubilities of the apatite crystals

CAP > HAP > FAP

- CAP is the largest percentage of apatite crystals present at eruption.

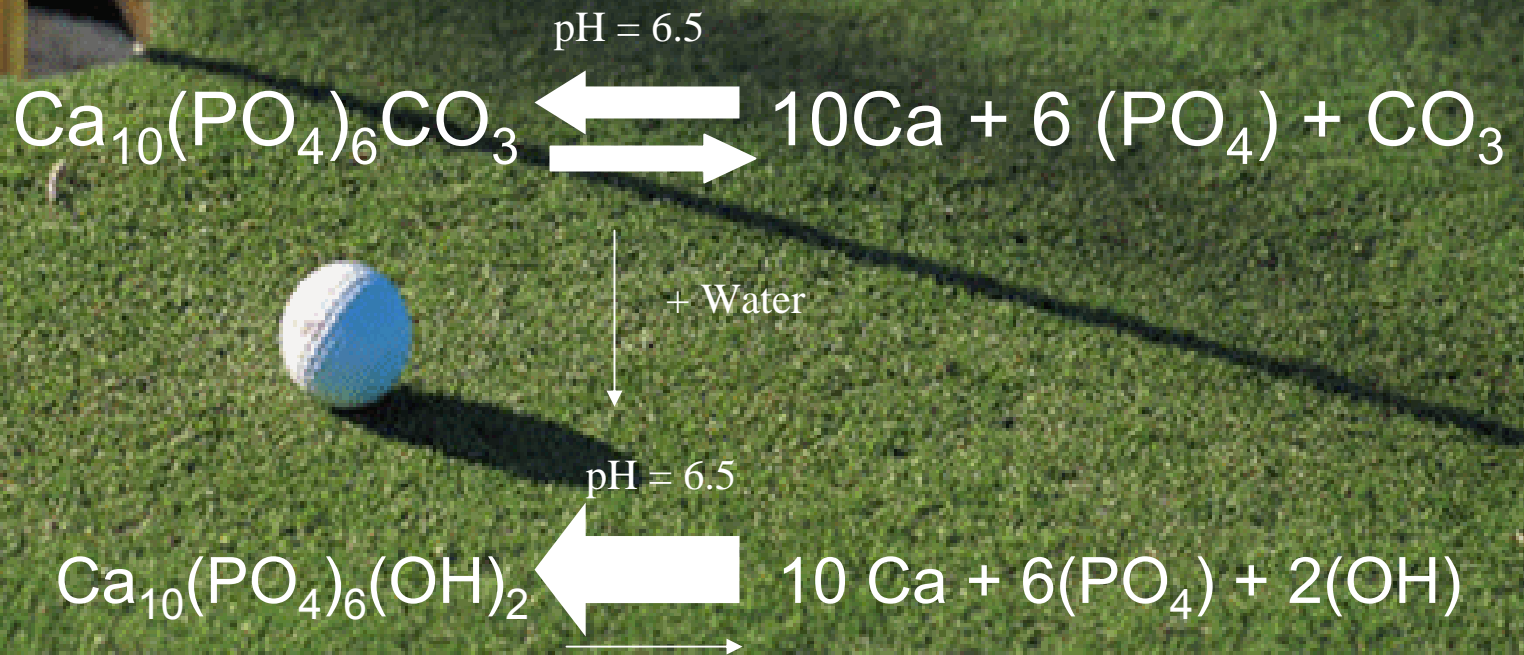
What is the Disease?

- Caries Process Review
 - Equilibrium concept of demineralization/remineralization



What is the Disease?

- Caries Process Review

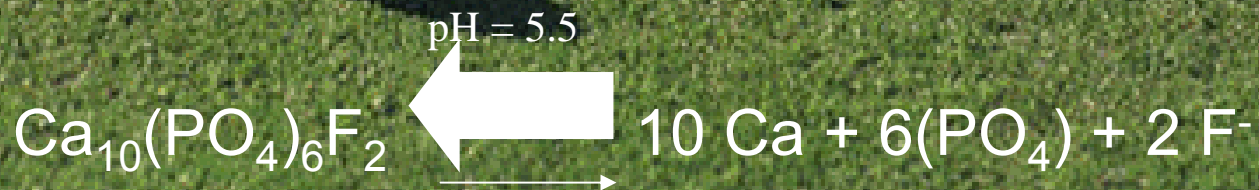


What is the Disease?

- Caries Process Review



Fluoride
Ion



What is the Disease?

- Caries Process Review



What is the Disease?

- Structure of the carious lesion.
 - Outer layer of enamel is intact in 60% of teeth with radiographic extension of lesion into the outer 1/3 of dentin.^{16, 17}
 - As long as outer enamel is intact, lesion can be re-mineralized.



Current Caries Management Research

- Featherstone, JDB. Caries Prevention and Reversal Based on the Caries Balance. *Pediatric Dentistry* 2006;28(2):128-32.
 - Reduce pathologic factors.
 - Cariogenic bacteria
 - Fermentable carbohydrates
 - Salivary dysfunction
 - Increase protective factors.
 - Salivary components and flow
 - Fluoride from extrinsic sources, calcium & phosphate.
 - Antibacterial therapy.

Current Caries Management Research

- How do we increase protective factors.
 - Salivary components and flow
 - Sugarless chewing gums (especially xylitol).¹⁻⁴
 - Fluoride from extrinsic sources, calcium & phosphate.
 - Toothpaste, fluoride rinses⁵, fluoride varnish*⁶, dietary calcium and phosphate⁷, CPP-ACP (Recaldent)⁸, ACP⁹
 - Antibacterial therapy.
 - Chlorhexidine¹⁰, iodophores¹¹.

Current Caries Management Research

- Is there an easier or less traumatic way to restore dental cavities?
- Atraumatic (Alternative) Restorative Technique (ART)



Current Caries Management Research

- What is ART?
 - Developed by European dentists providing 3rd world dental care in extremely remote locations.
 - Promoted by the WHO.
 - Technique utilizes spoon excavation of the lesion, usually without the need for local anesthesia, incorporating the indirect pulp cap technique, and restoration of the lesion with a self-setting restorative material, usually a glass ionomer.

Current Caries Management Research

- How is this atraumatic or painless?
 - Histology of the pulp-dentin complex in response to a carious challenge.
 - Dentin and pulp need to be considered as a functional unit, capable of defense reactions to a carious attack.

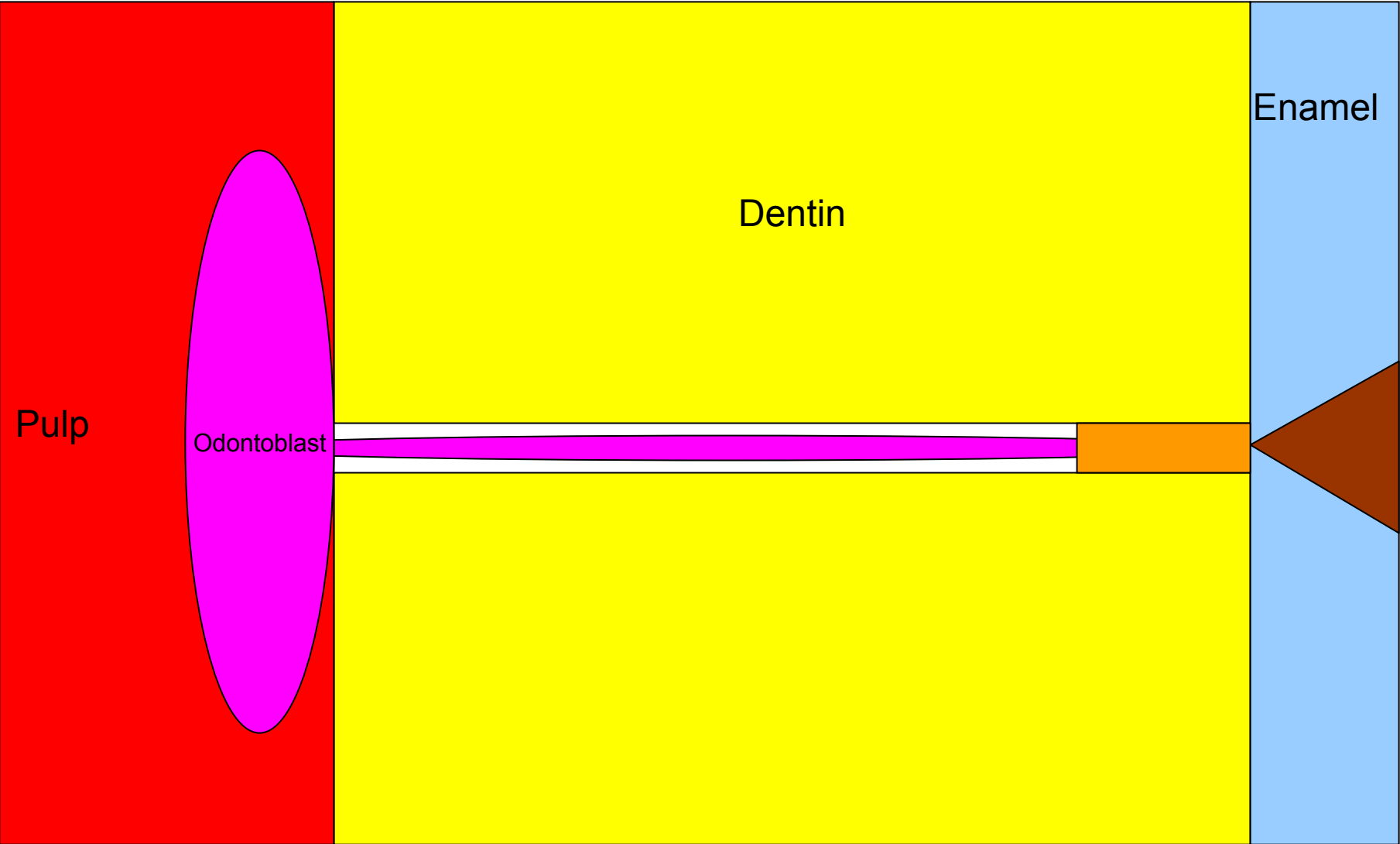
Current Caries Management Research

- How is this atraumatic or painless?
 - As enamel caries progresses into early dentinal lesions, defensive reactions in the pulp/dentin complex are histologically apparent.
 - 3 “degrees” of stimulation



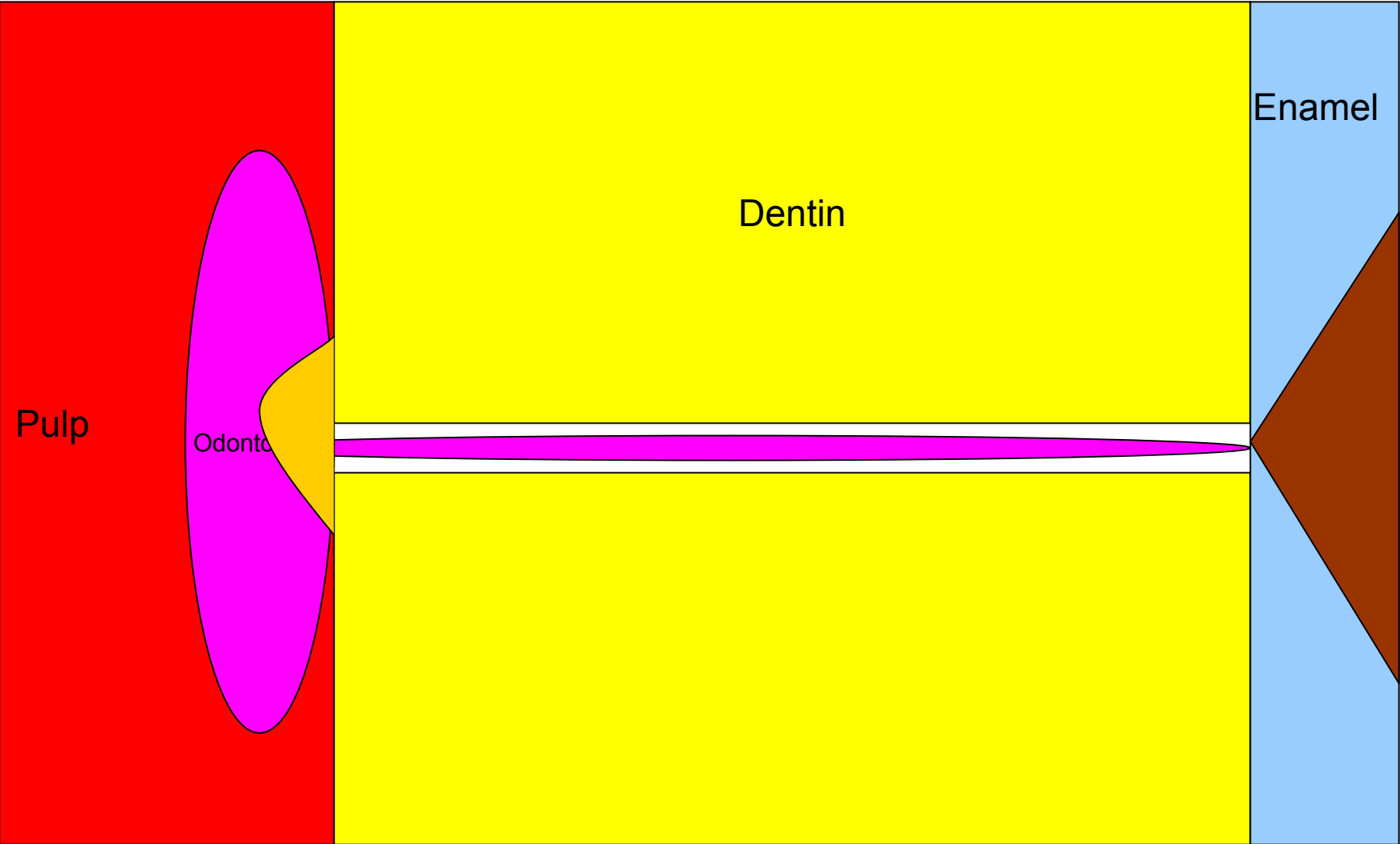
Current Caries Management Research

- How is this atraumatic or painless?
 - First degree reactions
 - Mild stimulations result in fatty degradation of the peripheral odontoblastic processes closest to the injury.
 - Fatty degradation undergoes calcification, sealing off the peripheral dentinal tubule.
 - Odontoblasts in pulpal tissues corresponding to affected tubular process showed partial atrophy and limited formation of reparative dentin.



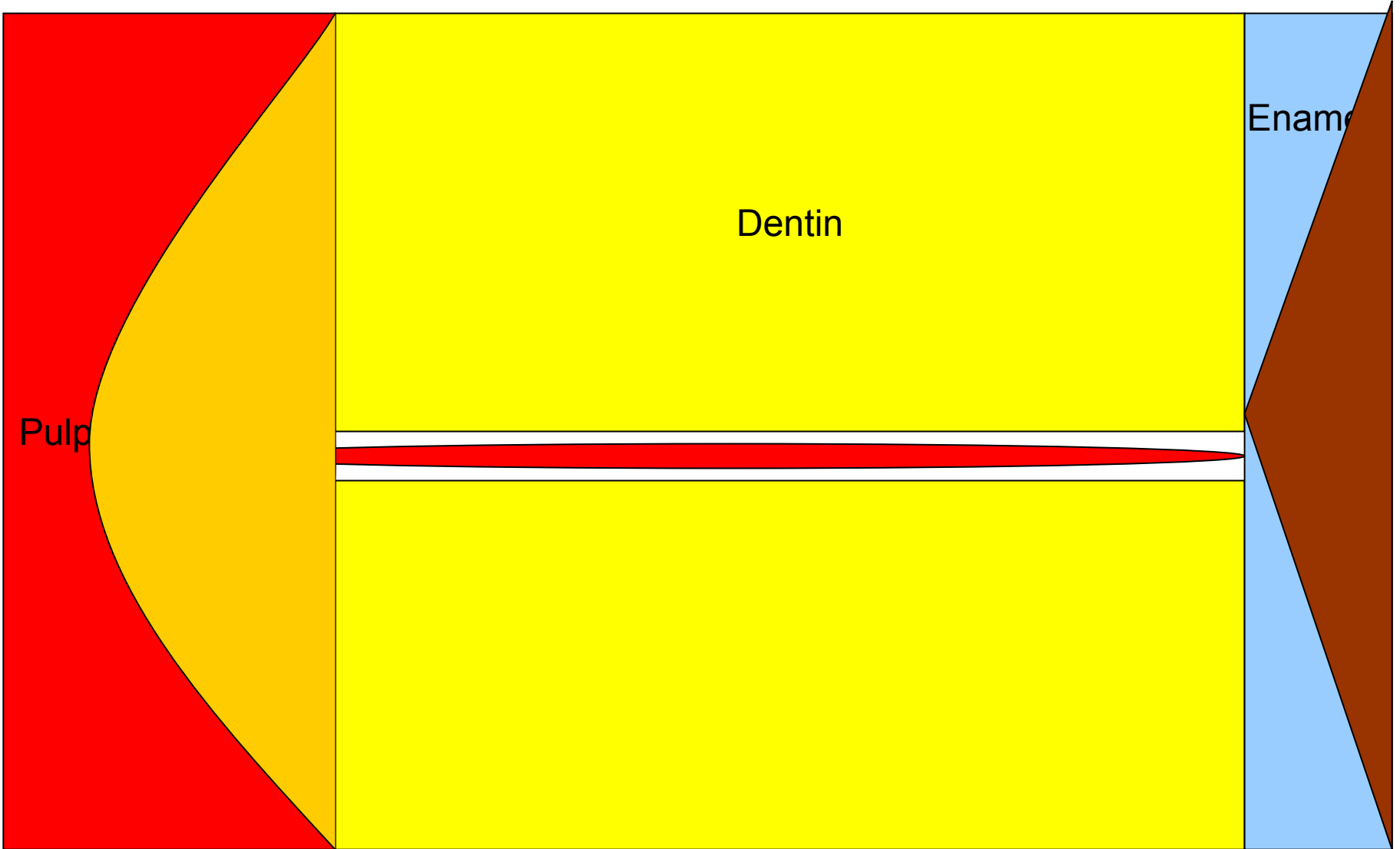
Current Caries Management Research

- How is this atraumatic or painless?
 - Second degree reactions
 - Injury causes degeneration of entire odontoblastic process.
 - Deposition of new matrix occurs at the pulp, producing a calcified barrier (reparative dentin). Atubular unless some odontoblastic process survives.
 - The now isolated remaining intertubular odontoblastic process becomes non-vital, resulting in a “dead tract”.



Current Caries Management Research

- How is this atraumatic or painless?
 - Third degree reactions
 - Similar to 2nd degree changes, but all injured odontoblasts progressively die and a completely atubular matrix forms and becomes calcified



Current Caries Management Research

- How is this atraumatic or painless?
 - The theory of pain stimulation in dentin is based upon the hydrodynamic stimulation of the odontoblastic process.
 - The distal calcification of the dentinal tubules eliminates the stimulation of the odontoblastic processes, thereby eliminating a painful reaction.

Current Caries Management Research

- How is this atraumatic or painless?
 - This plugging of the tubules forms a barrier that is probably more effective against the penetration by isotopes or dyes than any base or filling material.¹²



Current Caries Management Research

- How is this atraumatic or painless?
 - Two layers of dentin are known to exist.¹³
 - An outer, decomposed layer.
 - » Non-remineralizable, heavily infected with bacteria.
 - An inner, demineralized layer
 - » Remineralizable, lightly contaminated with bacteria.

Current Caries Management Research

- How is this atraumatic or painless?
 - By removing the outer, decomposed layer of dentin and preserving the inner, demineralized dentin and placing a fluoride-releasing restorative material (glass ionomer), this demineralized layer of dentin can be arrested and remineralized, reducing post-operative sensitivity.^{14, 15}

Current Caries Management Research

- What happens to the bacteria left in the demineralized dentin?
- Will it not cause secondary cavities?



Current Caries Management Research

- What happens to the bacteria left in the demineralized dentin?
 - Going RE, et al. The Viability of Microorganisms in Carious Lesions Five Years After Covering with a Fissure Sealant. *Journal of the American Dental Association* 1978;97:455-62.
 - Well applied sealants will retard or prevent the progression of decay.
 - Significant reduction in the number of viable microorganisms, too few to continue the carious process.

Current Caries Management Research

Simonsen RJ. Pit and Fissure Sealant: Review of the Literature. *Pediatric Dentistry* 2002;24(5):393-414.

- “This author has been unable to document the claim from some advocates of invasive exploration of apparently caries free, or minimally carious, fissures that bacteria that remain viable within the confines of a sealed fissure after sealant application (and assuming good clinical technique with all of the fissures sealed) can continue to produce acid from nutrients supplied from within the dentinal tubules. This claim appears specious at this time.”

Current Caries Management Research

- Mertz-Fairhurst EJ, et al. Ultraconservative and Cariostatic Sealed Restorations: Results at 10 Years. *Journal of the American Dental Association* 1998;129:55-66.
 - 3 treatment groups
 - Group 1 – conventional occlusal amalgam preparation.
 - Group 2 – removal of carious tissue without “extension for prevention” and sealant over the pit and fissure system.
 - Group 3 – Bevel in enamel around cavity, no caries removal at all, placement of resin over cavity, sealant of remaining pit and fissure system.

Current Caries Management Research

- Mandari GJ et al. Six-Year Success Rates of Occlusal Amalgam and Glass-Ionomer Restorations Placed Using Three Minimal Intervention Approaches.
 - 3 treatment groups
 - Conventional occlusal amalgam preparation in a dental school.
 - Modified-conventional in a field environment.
 - Ultraconservative in a field environment.

Current Caries Management Research

- Results:
 - Survival of all amalgams was 72.6%. Survival of all glass ionomer restorations was 72.3%.
 - No statistical differences between the survival rates of any of the three treatment groups.
- Conclusion: Art approach was equally effective as conventional amalgam placement for 6 years.

Current Caries Management Research

- What does the ADA have to say concerning sealing over cavities?
 - Council on Dental Health and Health Planning, Council on Dental Materials, Instruments, and Equipment, American Dental Association. Pit and Fissure Sealants. *Journal of the American Dental Association* 1987;114:671-2.

Current Caries Management Research

- “Considerable concern has been expressed regarding the potential placement of sealants over incipient carious lesions. Substantial data have been collected indicating that small caries (both diagnosed and undiagnosed) at the base of the fissure are arrested by sealant application. Caries-causing bacteria trapped beneath the resin do not regenerate, and incipient lesions do not progress.”

Current Caries Management Research

- Can I bond to carious dentin?
 - Nakajima M et al. Tensile Bond Strength and SEM Evaluation of Caries-affected Dentin Using Dentin Adhesives. *Journal of Dental Research* 1995;74:1679-88.
 - Results:
 - All Bond 2 and Clearfil Liner Bond II had higher bond strengths to normal dentin than to caries-affected dentin.
 - Scotchbond Multipurpose had similar bond strengths to both types of dentin.
 - Conclusion –Strength of adhesion to dentin depends on the type of dentin and the agents used.

Current Caries Management Research

- So what do I do in my practice?
 - I have incorporated the ART approach and sealing small cavities into my everyday practice.
 - I assess the activity of the lesion and how fast I believe it could progress.
 - I discuss profusely the preventive dentistry needs of daily brushing with a fluoride-containing product, flossing, diet modifications, and the use of chewing gums (both sugar-free and xylitol) to increase the protective factors and decrease caries risk.

Current Caries Management Research

- So what do I do in my practice?
 - I present my diagnosis of cavities forming or present, and discuss treatment options of conservative remineralization with fluoride varnishes, conventional restorative treatment (with anesthetic, sedation if necessary, etc.), and the use of the ART treatments if I feel they have a reasonable chance at success.

Current Caries Management Research

- So what do I do in my practice?
 - The ethical principles of self-determination require that I allow the parent (and patient if they are sufficiently mature) to choose the treatment that fits best with their treatment outcome goals and their comfort goals.
 - Many parents choose these alternative treatment methods.

Current Caries Management Research

- Success with these techniques (Based on observation, not hard data).
 - Class I and V ART restorations have a very good success rate - comparable to conventional restorations.
 - Class II and III Art restorations have about a 60% success rate – not a good as I would like. I've started adding mechanical retention to try and increase the longevity of the restorations.
 - Very good success rate with sealing small cavities.

Current Caries Management Research

- Success with these techniques (Based on observation, not hard data).
- The material I use (Fuji II) experiences occlusal wear more frequently than I would like to see.



Current Caries Management Research

- Success with these techniques (Based on observation, not hard data).
 - Behaviorally, I have good success.
 - I rarely use local anesthesia for the ART restorations with good cooperation from my patients.

Current Caries Management Research

- Success with these techniques (Based on observation, not hard data).
- Remineralization techniques without immediate restoration has approximately a 50% success rate, but in the year or two it takes to document radiographic increase in the size of the lesion, the patient has matured more and, probably because of the latent inhibition theory, they cooperate much better for the restoration.

Cases



Cases

- 6 y/o female with hypoplastic areas on the primary second molars.
- Referred because of significant anxiety about dental treatment.
- I restored “J” with a pulpotomy and SSC at a previous visit.



Cases

- Excavated soft caries with a spoon excavator without local anesthesia, leaving firmer, leathery dentin intact.



Cases

- Restored with Fuji II
- Tx time = 10 minutes
- Pt behavior – anxious but very cooperative and happy with treatment.



Cases

- 12 y/o female referred for extreme anxiety with dental tx. Unable to have restorative care completed even with 10mg valium at previous dental office.
- Occlusal lesion #19 with reversible pulpitis symptoms.
- Discussed tx options with mother including sedation, sedation with papoose, papoose without sedation, and ART techniques.
- Pt and parent immediately chose ART.



Cases

- Excavated soft carious dentin with spoon excavator, etched, bonded, and placed a flowable composite.
- Flowable touched up once with sealant, approx 3 years after original tx.

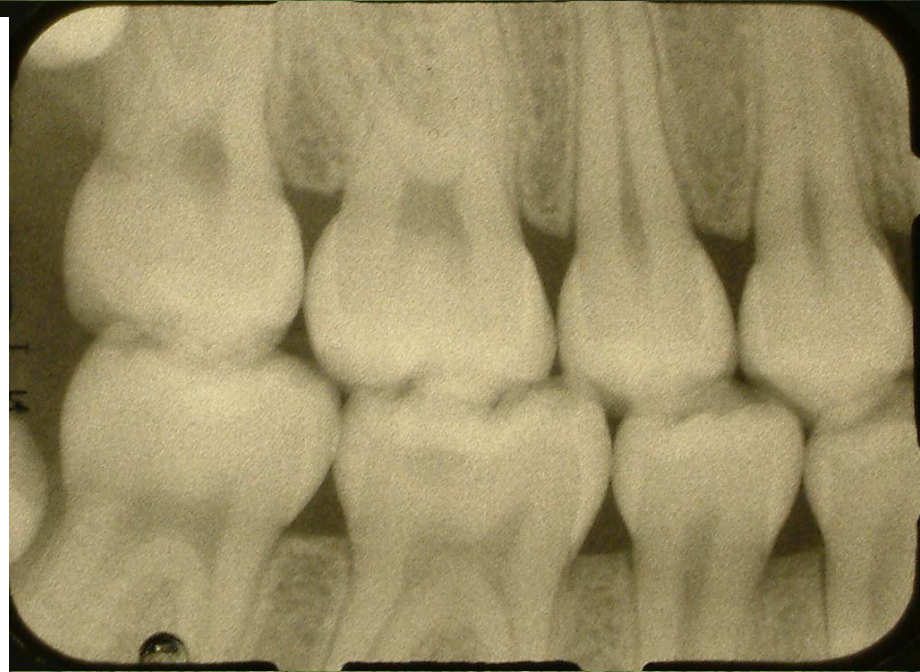


Cases

- 10 year follow-up (Pt now 22 and brought her own daughter in for infant oral exam).
- No radiographic or clinical evidence of caries progression,



Cases



Cases



10 Year clinical follow-up

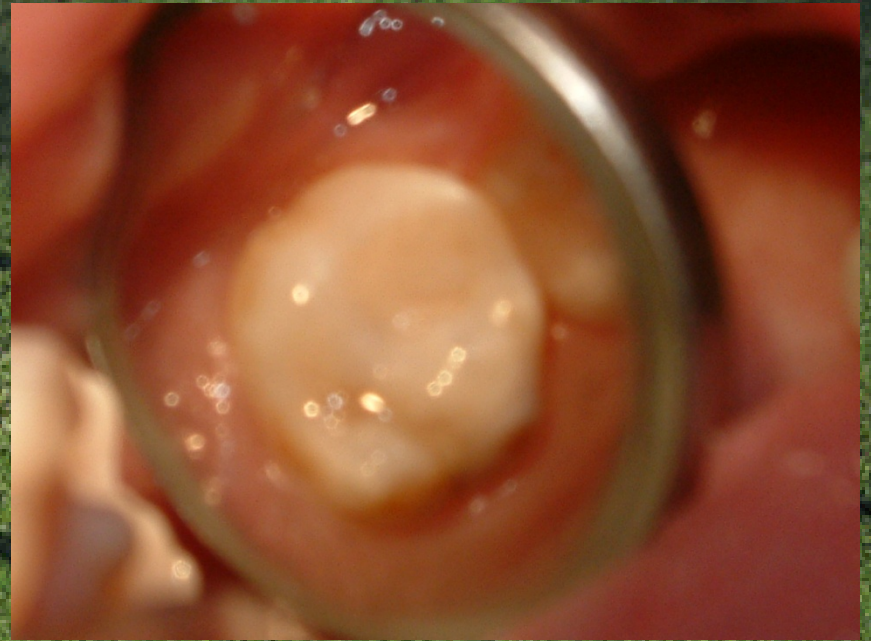
Cases

- 3 y/o male referred for filling #J.
- Very good, cooperative for exam, but short attention span.



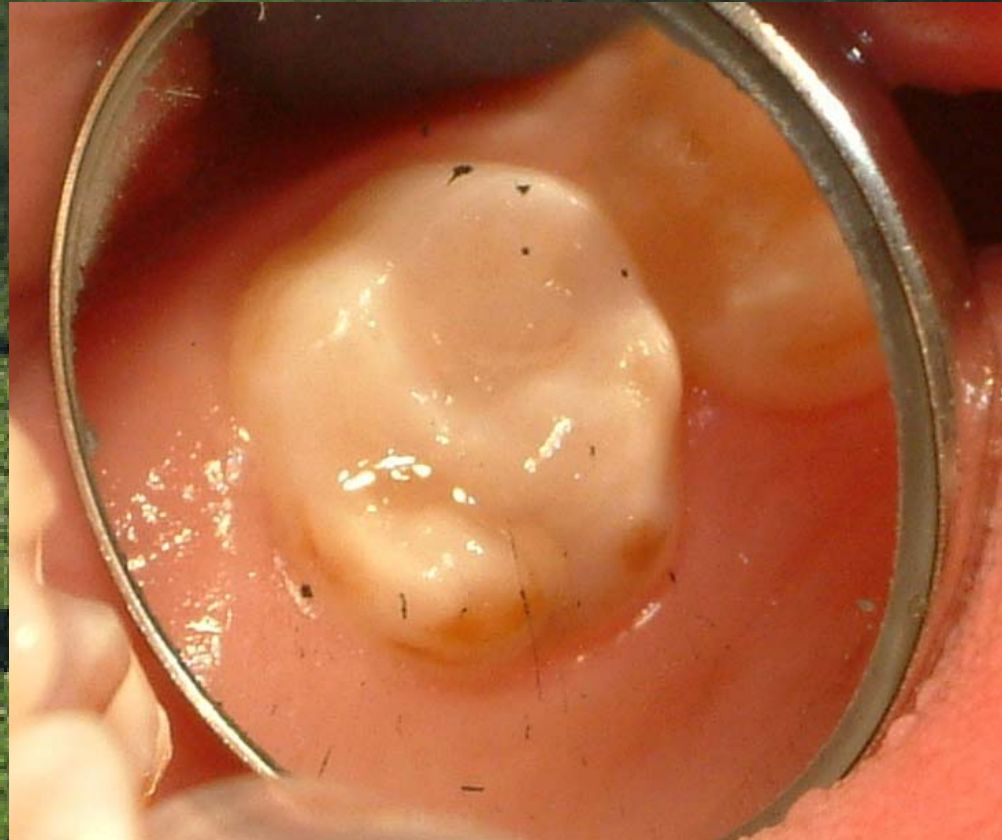
Cases

- After informed consent, placed sealant.



Cases

- 2 year follow-up



Questions?



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