Advantage
PREDICT protocol

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Outline

1. Cavities suck
2. Fluorides help
3. Antimicrobial progress
4. SDF = game changer
5. over-caries sealants
6. combine GIC + over-caries sealants
7. caries SI units: ICDAS/ASTDD
the dentistry story

Fillings stop cavities.

... and then you never get a cavity again.
we’ve been hosed.

• just kidding.

• 70% of GA cases recur in 1 year.

• dentistry addresses a symptom, not cause.
40-70% recurrence 1 year after GA treatment

only all SSCs or all EXTs don’t recur

Impact of dental caries

**Worldwide**
- 1/3 = most prevalent disease.
- Most humans affected.

**US**
- ~60 deaths.
- ~8K hospitalizations.
- ~50M school hours lost for kids w/ MediCal.
- ~$50B revenue to 48 insurances.
- >9/10 of disease is in poorest 1/4.

WHO, 2013; CDC, 2013; NIDCR, 2002
natural history of dental caries

ACID bacteria

SUGAR
sugar + caries = 
pouring fuel on the fire
The Caries Balance

Pathologic Factors (BAD)
- Bacterial infection
- Absence of saliva (xerostomia)
- Dietary habits poor

Protective Factors (SAFE)
- Saliva and sealants
- Antimicrobials
- Fluoride
- Effective diet

Caries

NO CARIES

Featherstone, 2000
childhood caries prevalence in Oregon

Caries rates in 6-9 year olds by county

Oregon Smile Survey, 2012
So what?

1. **Sugar causes caries.**
   = no changes. (decrease sugar)

2. **Fluoride strengthens teeth.**
   = no changes. (**TOOTHPASTE!!!**)

3. **Some bacteria do/don’t cause caries.**
   = control the bugs!

4. **Dentistry doesn’t stop dental caries.**
   = we need a smarter approach.
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Regular Fluoride at Home

- “grain of rice” of F toothpaste for children <2.5 yrs old
- “pea-size” of F toothpaste for children >2.5 yrs old

70% reduction in caries for children <8 yrs old
How much does varnish do?

F varnish vs no treatment:
- 59% less in 280 pts; no tx new caries: 1.7 surfaces.
- 56% less in 308 pts; no tx new caries: 1.6 surfaces.
- 24% less in 666 pts; no tx new caries: 9.6 surfaces.
- 18% less in 1,146 pts; no tx new caries: 13.4 surfaces.

each study went 2-2.5 years

= 1 - 2.4 less cavities per 2 years

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<table>
<thead>
<tr>
<th>Application</th>
<th>Frequency</th>
<th>Effect</th>
<th>Source</th>
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<td>Foam</td>
<td>Once</td>
<td>No Δ</td>
<td>Zhan et al., 2006</td>
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<tr>
<td>Liquid</td>
<td>Once</td>
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<td>Berkowitz et al., 2011</td>
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<td>80% less</td>
<td>Lopez et al., 2002</td>
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</table>

:. Liquid q2-3months
Chlorhexidine

- multicenter, double-blind, randomized clinical trial, 983 adults starting with 2+ caries.
- 4 x 1st month + once @ 6 months, eval @ 1 year

Outcomes produced similar findings. This trial failed to find that 10% (w/v) chlorhexidine diacetate coating was superior to placebo coating for the prevention of new caries (ClinicalTrials.gov registration number NCT00357877).
unexpected glory
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38% w/v silver diamine fluoride

Colorless liquid

- 25% silver: antimicrobial
- 8% ammonia: solvent
- 5% fluoride: remineralization
SDF, what does it do?

Arrests dental caries

Prevents dental caries
  • *directly & indirectly*

Decreases dentin hypersensitivity
SDF, how does it work?

penetrates deep

reacts with everything
SDF resists demineralization

silver diamine fluoride

control

CH Chu
zombie effect of silver
Caries arrest

Llodra et al., 2005
373 6 year olds
3.2 lesions at start

Zhi et al., 2012
181 3-4 year olds
3.4 surfaces at start

Chu et al., 2002
308 3-5 year olds
6 lesions at start

Zhang et al., 2013
227 60-89 year olds
0.91 lesions at start

Yee et al., 2009
624 3-9 year olds
6.8 lesions at start

Santos et al., 2014
322 5-6 year olds
3.8 lesions at start
Caries prevention

Llodra et al., 2005
373 6 year olds
control: 2.5 new lesions
(only applied to lesions)

Liu et al., 2012
482 9.1 year olds
control: 4.6 new lesions

Chu et al., 2002
308 3-5 year olds
control: 1.6 new lesions
(only applied to lesions)

Tan et al., 2010
203 79 year olds
control: 2.5 new lesions

Zhang et al., 2013
227 60-89 year olds
control: 1.3 new lesions

Monse et al., 2012
708 6-8 year olds
control: 0.44 new lesions
1.5 year outcome – 5 year old with special needs
Silver Diamine Fluoride
Where did this come from?

- **Silver Nitrate** used globally for >1000 years.
  - Caries arrest case series & protocols in 1800s.
  - 1891: 87 of 142 treated lesions were arrested.
  - Founding fathers of dentistry had protocols.
- **AgF** used in Japan for ~900 years.
  - Cosmetic blackening of teeth
  - Known to prevent caries.
- **NH₃⁺** added >80 years ago = SDF.
  - Approved & monitored by Japan.
- **Available in Australia, Brazil, Argentina, Cuba, China** since 1980s or before...
- ... and now in the USA. Cleared by FDA !!!

*J Dent Res* 81:767
SDF, how safe is it?

- No adverse reports in >80 years of use in Japan.

- **Contraindication**
  - Silver allergy.

- **Relative contraindication:**
  - Significant desquamative processes e.g. ulcerative gingivitis, stomatitis
  - Protect by petroleum jelly

- **Side effects:**
  - Small, white mucosal lesions
    - disappear in 48 hours.
  - It will stain the lesion black.
  - 14 days: mild gastric inflammation.
Ag & F safety

- **Fluoride**
  - ~50,000 ppm (5%) fluoride = highest available.
  - No known significant risk for this level of **acute exposure**.

- **Silver**
  - ~25% silver.
  - No known medical risks of ingesting silver.
  - Argyria: bluing of the skin
    - EPA lifetime exposure: 1 gram.
    - Highest applied dose for 3 permanent teeth: 2.37mg
    - = ~1,266 lifetime treatments.
How much *can* you use?

- FDA rat & mouse LD50 studies:
  - Oral LD50 = 520 mg/kg
  - Subcutaneous LD50 = 380 mg/kg

- 100% absorption of 20uL drop in 10kg child
  ~15 month old = 0.76 mg/kg
  - 500-fold LD50 safety margin.

- NAOEL level for 14 days of daily exposure = 1.3 mg/kg
  - Higher levels resulted in mild gastric inflammation.

UCSF limit: 1 drop per 10kg per visit.
SDF staining

time 0 1 day 1 week

J Dent Res 88:116
SDF is now available in the U.S.

- $100/bottle = ~250 drops
- 31¢/drop
- CDT code for caries arrest approved for 2016: D1354.

FDA clearance = hypersensitivity.

Off label use = caries treatment.

This is the same as fluoride varnish.
Person and Clinic Protection

- Permanent dark staining of clinic surfaces and clothes.
  - Does not come out after setting (exceptions).
  - Clean immediately with copious water, ethanol, or high pH solvents such as ammonia.

- Temporary staining of skin
  - Rinse.
  - Will go away in days.
  - No harm.
SDF take-homes

1. SDF arrests >90% caries when used 2/year.

2. Powerful indirect prevention.

3. Dry before use.

4. SDF stains the crap out of everything.
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Seal over initial caries with GIC

“sealants can prevent the progression of early noncavitated carious lesions.” = ICDAS 1-2.

“These clinical recommendations... include use of a glass ionomer cement material”
10 year follow up of 170 paired molars (n=312 at start)

pre-operative 6 years 10 years

JADA 1998, 129:55
Atraumatic Restorative Technique (ART)

DeAmorim et al., Clin Oral Invest, 2012

Table 2. Overview of survival results (in percent) SE and 95% CI of single-surface ART restorations using high-viscosity glass ionomers in primary posterior teeth by location and year of survival.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Location</th>
<th>Year of survival</th>
<th>Survival</th>
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Table 3. Overview of survival results (in percent) SE and 95% CI of multiple-surface ART restorations using high-viscosity glass ionomers in primary posterior teeth by location and year of survival.

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DeAmorim et al., Clin Oral Invest, 2012

multiple surface ART

single surface ART

year 1 | 95%
year 2 | 93%
year 3 | 66%

year 1 | 71%
year 2 | 62%
year 3 | 31%
In some patients, the open control cavity tended to become sensitive to a cold stimulus or the pressure exerted during lesion depth measurements and during bacterial sampling. This discomfort usually correlated with measured depth increases and perceptible radiographic changes. The control tooth always served as the determining factor in the termination of the study in each patient, as no discomfort occurred in any of the treated teeth. Little correlation existed between the development of sensitivity of the control tooth to cold, to pressure, or to chewing and the rate of increase in depth (above average or below average) in the control lesion. Three control teeth

Discussed

EPIDEMIC NATURE, surmised by episodic extension, taken per lesions in nature of cause and

$10^5$ mutans streps vs zero under sealant @1-17 months
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Resin bond unaffected

Quock et al., Op Dent, 2012

n=49 for each
GIC bond – better?

-.. etch / condition
- rinse
- SDF
- rinse
- GIC

Yamaga, *Dent Mater J*, 1993


photo courtesy of John Frachella
Combination with GIC sealants: Modified-ITRs (ITR=ART)

- Glass Ionomer Cements (GICs) add the benefit of sustained fluoride release and a seal!
- Protocol: SDF, then standard GIC protocol.

(they darken over time)

Courtesy of Dr. John Frachella
GIC stain by SDF

SDF + GIC
- Fuji 9
- 1 month

SDF + GIC
- Shofu FX-II
- 1 month

3x SDF; no-prep GIC
- Shofu FX-II
- 2 weeks

Courtesy of Dr. John Frachella
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ICDAS
0 = no lesion.
1 = lesion only in fissure.
2 = no cavitation, beyond fissure.
3 = microcavitation, no dentin seen.
4 = shadow.
5 = significant cavitation.
6 = lesion > ½ tooth in any dimension.
PREDICT treatment simplified

**ASTDD 0**
- **ICDAS**
  - 0-1 only: hygiene.
  - 2-4 only: 2/year SDF

**ASTDD 1a =**
- 5-6, no interproximal: SDF+GIC,
  - + 4/year Iodine + F varnish
  - + 2/year SDF

**ASTDD 1b =**
- 5-6 & interproximal: restoration.
  - + 4/year Iodine + F varnish
  - + 2/year SDF

**ASTDD 2 =**
- signs of infection
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THANK YOU