Incomplete Caries Removal, Caries Risk Assessment, and Suspicious Occlusal Caries Lesions

Jim Bader DDS, MPH
Research Professor
School of Dentistry
University of North Carolina
Incomplete Caries Removal
Incomplete Caries Removal

What do you anticipate will be needed?

• pulp cap?
• pulpotomy?
• endodontic treatment?
Incomplete Caries Removal

If the patient has:

a deep lesion ( >1/2 dentin thickness)
no signs of irreversible pulpitis
positive to cold
negative to percussion
no spontaneous pain
no periapical lesion

Then.........
Incomplete Caries Removal

You should consider incomplete caries removal. That is, deliberately leave caries in the preparation if it is close to the pulp. Horrors!
Incomplete Caries Removal

Your Operative Dentistry instructor will be outraged
Incomplete Caries Removal

but the evidence says you will be saving pulps
Incomplete Caries Removal

but the **evidence** says you will be saving pulps
What is evidence?

(digression)
Evidence is information from the dental knowledge base

What is the dental knowledge base?

“sum total of what the profession knows”

“the dental literature”
Is a paper in the dental literature “Evidence?”

single paper = “a piece of evidence”

“Evidence” (as in Evidence-based Dentistry):

• a synthesis of all available information that addresses a specific clinical question
Synthesis

locates and combines *all the* information that addresses the same question:

- searching the literature thoroughly
- including all information that meets criteria for relevance
- risk of bias
- combining the information statistically, if possible
- reporting the evidence in a systematic review
Systematic review
follows an expected protocol and format

• clinical question to be addressed
• criteria for inclusion of studies
• study search and selection methods
• results and risk of bias of each included study
• the synthesis (meta analysis)

the least biased method for assembling the evidence......
Evidence Pyramid

- Systematic Reviews
- Randomized Controlled Trials
- Cohort Studies
- Case-Control Studies
- Case Series, Case Reports
- Editorials, Expert Opinion
Evidence Pyramid

(End of Digression)
So let’s look at the evidence for **incomplete caries removal** aka
**indirect pulp treatment**
**indirect pulp cap**
**partial caries removal**
Incomplete Caries Removal Methods

method 1 = one step (single entry)

method 2 = stepwise (multiple entry)
Outcomes for Incomplete and Complete Caries Removal

2 systematic reviews: RCTs of incomplete vs complete outcomes = rates for pulp exposure and annual failure

<table>
<thead>
<tr>
<th>Study</th>
<th>n of studies</th>
<th>n of teeth</th>
<th>Pulp exposure</th>
<th>Annual failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schwendicke, 2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one-step</td>
<td>6</td>
<td>376</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>stepwise</td>
<td>4</td>
<td>376</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>complete removal</td>
<td>10</td>
<td>741</td>
<td>32%</td>
<td>9%</td>
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<tr>
<td>Ricketts, 2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one step</td>
<td>3</td>
<td>92</td>
<td>5%</td>
<td>-</td>
</tr>
<tr>
<td>stepwise</td>
<td>4</td>
<td>324</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>complete removal</td>
<td>8</td>
<td>669</td>
<td>28%</td>
<td>-</td>
</tr>
</tbody>
</table>
Outcomes for Incomplete and Complete Caries Removal

single study RCT: of one step vs complete removal exposure and annual failure rates: (primary teeth only)

<table>
<thead>
<tr>
<th></th>
<th>n of teeth</th>
<th>pulp exposure</th>
<th>annual failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>one-step</td>
<td>66</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>complete removal</td>
<td>54</td>
<td>28%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Franzon, 2014
Outcomes for Incomplete and Complete Caries Removal

single study: RCT of one-step vs stepwise
exposure and annual failure rates: (permanent teeth only)

<table>
<thead>
<tr>
<th></th>
<th>n of teeth</th>
<th>pulp exposure</th>
<th>annual failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maltz, 2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one-step</td>
<td>112</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>stepwise</td>
<td>101</td>
<td>3%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Outcomes for Incomplete and Complete Caries Removal

Additional findings:

liner/base may not make a difference
most restored with composite resin
survival is poorer with involvement of 2+ surfaces
apparently no difference by age or primary/permanent
bacterial load is reduced in remaining carious dentin
What we don’t know as much about:

• when and how these restorations fail

_Schwendicke 2014_ 10 RCTs, 9 pro- & retrospective studies

overall AFR 3.8%

majority of failures due to pulpal symptoms

non-pulpal failures usually caries at the margin

catastrophic fractures rare
Incomplete Caries Removal

So....

That's the evidence,

What are you gonna do?
Topic # 2
Caries Risk Assessment
Caries Risk Assessment

- Risk
- Health Risk Assessment
- Caries Risk Assessment
  - history
  - current status
  - four CRA systems
  - lessons learned
What do you think of when you hear the word “Risk”? 
Hazard
Peril
Risk

Harold Lloyd, ‘Safety Last,’ 1923
Loss
Risk is the Probability of disease
Health Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease*
Health Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease”

*CDC*
Health Risk Assessment

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Health Risk Assessment

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*CDC*
Health Risk Assessment

Three Steps:

1. identify an individual’s specific risk level and risk factors

2. feed back the risk level together with the risk factors that contribute to the risk

3. work with the individual to commit to intervention(s) to reduce risk level
Have you had a HRA?

• Introduced in the 1970s

• popularized in the 1980s

• First was for CVD, based on findings from the Framingham study
Risk Assessment Tool for Estimating Your 10-year Risk of Having a Heart Attack

The risk assessment tool below uses information from the Framingham Heart Study to predict a person’s chance of having a heart attack in the next 10 years. This tool is designed for adults aged 20 and older who do not have heart disease or diabetes. To find your risk score, enter your information in the calculator below:

Age: [years]
Gender: [Female] [Male]
Total Cholesterol: [mg/dL]
HDL Cholesterol: [mg/dL]
Smoker: [No] [Yes]
Systolic Blood Pressure: [mm/Hg]
Are you currently on any medication to treat high blood pressure: [No] [Yes]

Calculate Your 10-Year Risk

Total cholesterol - Total cholesterol is the sum of all the cholesterol in your blood. The higher your total cholesterol, the greater your risk for heart disease. Here are the total values that matter to you:

Less than 200 mg/dL 'Desirable' level that puts you at lower risk for heart disease. A cholesterol level of 200 mg/dL or greater increases your risk.

200 to 239 mg/dL 'Borderline-high.'
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Age: 55 years
Gender: Male
Total Cholesterol: 225 mg/dL
HDL Cholesterol: 35 mg/dL
Smoker: Yes
Systolic Blood Pressure: 130 mm/Hg

Are you currently on any medication to treat high blood pressure.

[Select Yes or No]

Calculate Your 10-Year Risk

---

Total cholesterol - Total cholesterol is the sum of all the cholesterol in your blood.
### Information about your risk score:

- **Age:** 55
- **Gender:** male
- **Total Cholesterol:** 225 mg/dL
- **HDL Cholesterol:** 35 mg/dL
- **Smoker:** No
- **Systolic Blood Pressure:** 130 mm/Hg
- **On medication for HBP:** Yes

**Risk Score**: 13%

Means 13 of 100 people with this level of risk will have a heart attack in the next 10 years.

*Your risk score was calculated using an equation. Other NCEP products, such as printed ATP III materials, use a probability calculator to determine a risk score that is close to the equation score.*

To find out what your risk score means and how to lower your risk for a heart attack, go to “High Blood Cholesterol—What You Need to Know.”
Caries Risk Assessment

Caries Risk Assessment
Very Brief History of CRA

1880-- bacterial etiology first proposed (WD Miller)
BACTERIA AND DENTAL CARIES. (PRELIMINARY REPORT.)

S. A. HOSKINS, M.D.

(From the Bacteriological Laboratory of the Harvard Medical School.)

This work was undertaken to discover, if possible, the causes which lead to dental caries. It seemed reasonable to hope that if the various processes of tooth decay could be accurately followed some suggestion for preventing or at least retarding the process might arise.

There have been many theories promulgated to account for the destruction of the teeth, and it is unnecessary to review them all.

Up to ten or fifteen years ago the theory generally received was that which ascribed to chemical action alone the destructive changes which take place in the human teeth. About that time, Miller, of Berlin, who did excellent work in the study of the bacteria of the human mouth, found, as he believed, that the destruction of the human teeth was an acid process due to the action of lactic acid. This lactic acid, he believed, was produced by bacteria which found a suitable media for their development in the food particles which remained in the mouth after eating and which became mixed with broken-down epithelial cells and saliva. This was generally known as the chemico-bacterial theory and is the theory almost universally held at the present time.

The notable differences which were seen to occur in the action of the destructive agents upon teeth in different mouths and upon different teeth in the same mouth were supposed to be due to differences in the structure of teeth which made some teeth much more resistant to caries than others.

Three or four years ago Dr. Black, of Indiana, conducted series of experiments which must have been as laborious in character as they were surprising in results. He subjected a very large number of extracted teeth to a very great variety of tests. He measured their specific gravity, subjected them to various pressure tests, made microscopical examinations
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Very Brief History of CRA

1880--bacterial etiology first proposed (WD Miller)
1910s--evaluation of cariogenicity of foods
evaluation of physiologic factors
Experiments and Observations on Bread, with Special Reference to the Causation and Prevention of Dental Caries.

By J. Sim Wallace, M.D., L.D.S.

I never was quite satisfied with some experiments carried out by Mr. H. Candy under the direction of Mr. T. G. Read, and for many years hoped to see them corroborated or refuted.

You will remember that these experiments were said to show that during mastication ordinary steel-milled white bread gave rise to 43 per cent. more acid than did bread made from stone-milled flour. These experiments appear to have given rise to the impression or assumption that white bread fermented more rapidly in the mouth that did bread made from stone-milled flour. It was impossible for me to gather from the published reports the significance of Mr. Read's experiments. I am now willing, however, to accept the statement about the extra 43 per cent. of acid being produced from the white bread, but only on the supposition that, to all intents and purposes, no acid is produced during the mastication of the stone-milled bread, and that $0 + 43$ per cent. of $0$ is produced during the mastication of the white bread. The reason for my saying this is, that when stone-milled bread and when white bread are masticated and then ejected into a suitable vessel, it will be found that both are distinctly alkaline. Moreover, if equal amounts of bread made from stone-milled flour and from white bread ...
The Influence of the Thyroid Gland upon Dental Caries.

By Herbert Ewan Waller, L.R.C.P.Lond., M.R.C.S.Eng. (Birmingham).

Dental caries, though a well-worn subject, is still profitable for discussion. And I venture to state that the real cause is not yet appreciated in its true light. Without wishing to belittle the patient research and brilliant results of those who have demonstrated the essential influence of carbohydrate fermentation on the actual process of decay, I take this opportunity of protesting that it is unwarrantable, on that account, to assume that dental caries is merely a question of diet.

The details of the process of decay are well known to you, but to avoid any misunderstanding perhaps I ought to recite them. First, then, we have the lodgment of carbohydrate material upon the teeth. Secondly, the fermentation of this material, brought about by organisms in the mouth, with the consequent production of acids, of which lactic acid is the chief. Thirdly, solution of the lime salts of the enamel and dentine by these acids; and, finally, a further destructive process by bacteria, which liquefy the decalcified dentine. This I believe to be a fair summary of present opinion on the subject. Granting, then, that carbohydrate fermentation is an essential factor in dental caries, does it follow that increased dental caries is merely due to an increase of carbohydrate diet? I think not, for the following reasons:—
CXV. THE RELATION OF CALCIUM IN THE SALIVA TO DENTAL CARIES.

BY KATHLEEN HORTON, JOHN MARRACK AND IVOR PRICE.

From the Hale Clinical Laboratory, London Hospital.

(Received August 29th, 1929.)

Pattison [1926] concluded that there seems to be some connection between the quantity of calcium in the saliva and dental caries, but to prove this a more prolonged investigation would have to be made. In the following work we have studied this connection on numbers of patients sufficient to exclude the effect of chance variations.

Methods.

Calcium was estimated by the method of Clark [1921] with the modification, suggested by Stanford and Wheatley [1925], of washing the calcium oxalate precipitate with a saturated solution of calcium oxalate instead of distilled water. Before precipitation of calcium as oxalate the mucin in the saliva was removed as far as possible; a drop of 10% acetic acid was added; the saliva was shaken for half an hour and then filtered through an ash-free paper.

The most likely sources of error in this method are the contamination of the calcium oxalate precipitate with organic matter and the loss of calcium with the precipitated mucin. To check this, estimates were also made on 27 samples by incinerating without removing mucin, dissolving the precipitate in dilute HCl, neutralising to methyl red and continuing the estimation on this solution. On the average, the results by the incineration method were 0.15...
Very Brief History of CRA

1880--bacterial etiology first proposed (WD Miller)
1910s--evaluation of cariogenicity of foods
   evaluation of physiologic factors
1930s--evaluation of the role of specific bacteria
Lactobacillus Acidophilus and Dental Caries

PHILIP JAY, D.D.S.
School of Dentistry, University of Michigan, Ann Arbor, Mich.

DENTAL caries, due to its widespread distribution and steadily increasing incidence, is worthy of the serious attention of students of public health problems. It is the purpose of this report to emphasize a few established facts in the hope that a clearer concept may be had of the etiology and control of the disease.

At the turn of the century W. D. Miller ¹ advanced the hypothesis that there is present in the saliva an acidogenic substance which is responsible for the initial decalcification of presence of lactobacilli is invariably associated with caries. A renewal of caries activity in susceptible patients was always presaged by a marked increase of the oral lactobacilli as determined by quantitative culture of the saliva, while a drop in the lactobacillus count always signified an arrest of caries.

These findings were not very enthusiastically received since various investigators both at home and abroad were reporting the successful control of the disease by dietary means. All
Very Brief History of CRA

1880--bacterial etiology first proposed (WD Miller)
1910s--evaluation of cariogenicity of foods
evaluation of physiologic factors
1930s--evaluation of the role of specific bacteria
1940s--evaluation of the effects of fluoride
(protective factor)
Very Brief History of CRA

1950-1970’s--emphasis on universal prevention
  • fluoridation of water supplies
  • office application of topical fluoride
  • promotion of fluoride toothpaste
  • patient education on etiology of caries
Caries Risk Assessment

- TOOTH
  - Age
  - Fluorides
  - Morphology
  - Nutrition
  - Trace Elements
  - Carbonate Level

- FLORA
  - Strep. Mutans (Substrate)
  - Oral Hygiene
  - Fluoride in Plaque

- SUBSTRATE
  - Oral Clearance
  - Oral Hygiene
  - Salivary Stimulants
  - Frequency of Eating
  - Carbohydrate (type, concentration)
Caries Risk Assessment

* Fermentable Carbohydrate
** Particularly Streptococcus mutans
Caries Risk Assessment

Host factors
- Nutrition, genetics, behavior, race, age
- Plaque bacteria
- Nutrients and food components
- Minerals, T.E., and fluoride status
- Saliva flow and composition

Caries
What did these diagrams do?
taught etiology of dental caries

What did we want patients to do?
change their behaviors
Caries Risk Assessment

Very Brief History of CRA

By 1950--knowledge of the basic etiology of caries

1950-1970’s--emphasis on universal prevention
  • fluoridation of water supplies
  • office application of topical fluoride
  • promotion of fluoride toothpaste
  • patient education on etiology of caries

Principal risk factors for caries identified----But:
  no individual risk level estimates
  specific individual risk factors not necessarily identified
  “caries prone, ” “soft teeth”

But:
Very Brief History of CRA

By 1950--knowledge of the basic etiology of caries

1950-1970’s--emphasis on universal prevention
  • fluoridation of water supplies
  • office application of topical fluoride
  • promotion of fluoride toothpaste
  • patient education on etiology of caries

1980-2000’s--attention to “caries prediction”
  • first step in caries risk assessment
  • attempts to identify individuals at “high risk”
  • refinement of knowledge of risk factors
Five Issues with Caries Prediction

• accuracy of risk models--160% rule
Caries Risk Assessment

rule of 160%: sensitivity + specificity must be 160% for a risk model to be useful*

risk model = mathematical combination of risk factors that estimates an individual’s risk of caries

sensitivity = proportion of true “high risk” individuals identified as high risk by the risk model

specificity = proportion of true “low risk” individuals identified as low risk by the risk model

Thus, a risk model must on average correctly classify at least 80% of those at “high risk” and 80% of those at “low risk”

*Bohannan, 1987
Five Issues with Caries Prediction

• accuracy of risk models--160%rule
• clinical practicality of risk factors
Caries Risk Assessment

clinical practicality of risk factors

salivary flow rate
salivary buffering capacity
mutans strepococci level in plaque, saliva
lactobacillus level in saliva
Five Issues with Caries Prediction

• accuracy of risk models--160% rule
• practicality of risk factors used in risk models
• cross-sectional versus longitudinal risk models
Caries Risk Assessment

cross-sectional vs. longitudinal risk models

diagram:

exam → caries prevalence → risk factors

red arrows indicate correlations or influences
Caries Risk Assessment

cross-sectional vs. longitudinal risk models

exam \[\rightarrow\] exam

time (1-2 years)

caries prevalence \[\rightarrow\] caries prevalence

risk factors
Caries Risk Assessment

cross-sectional vs. longitudinal risk models

exam → exam

risk factors → caries prevalence → caries prevalence → caries incidence

time (1-2 years)
Five Issues with Caries Prediction

• accuracy of risk models—160% rule
• practicality of risk factors used in risk models
• cross-sectional versus longitudinal risk models
• validation of risk models
Caries Risk Assessment

validation

Preventive interventions?

time (1-2 years)

exam → exam

caries prevalence → caries prevalence

risk factors → caries incidence

exam
Caries Risk Assessment

Five Issues with Caries Prediction

• accuracy of risk models--160% rule
• practicality of risk factors used in risk models
• cross-sectional versus longitudinal risk models
• ethical problems with validation of risk models
• generalizability of risk models
Five Issues with Caries Prediction

• generalizability—can I use the model for my patients?

populations
• small numbers of subjects
• almost all based on children
• majority non-US

high risk definition
• any lesion
• number of lesions
• top X % of population
Caries Risk Assessment

Current Status of Caries Prediction

- over 90 risk models reported in the literature 1980-present*
- most do not meet the 160% rule*
- only about ½ of the models based on longitudinal data*
- almost none have been thoroughly validated*
- unknown generalizability to dissimilar patient populations*
- some risk factors difficult to assess in practice

caries prediction is an inexact science

*Mejäre et al, 2014
Very Brief History of CRA

By 1950--knowledge of the basic etiology of caries

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  • fluoridation of water supplies
  • office application of topical fluoride
  • promotion of fluoride toothpaste
  • patient education on etiology of caries

1980-2000’s--attention to “caries prediction”
  • knowledge of risk factors refined
  • attempts to identify individuals at “high risk”

1995--advent of caries risk assessment
  • JADA supplement “Caries Diagnosis and Risk Assessment”
Caries Risk Assessment

Current Status of CRA

• currently more than 15 assessment forms available on the internet

• unknown proportion of dentists routinely performing “full” caries risk assessment

• in a regional survey, 2/3s of dentist members of a PBRN reported using CRA “in some way.”*

• 17% used a form to record risk*

• 52% individualized the caries prevention protocol*

*Riley et al, 2011
CRA Systems

- 4 systems seem to be the most frequently mentioned in the literature*

  AAPD’s CRA guidelines (forms and protocols)
  ADA’s CRA forms
  CAMBRA forms and protocols
  Cariogram program and protocols

*Tellez, 2013
Caries Risk Assessment

American Academy of Pediatric Dentistry:
Guideline on Caries-risk Assessment and Management for Infants, Children, and Adolescents (CAT)
(revised 2011)

3 caries risk assessment forms, and
3 example caries management protocols:
  age 0-3 (for non dental professionals)
  age 0-5
  age ≥6
### Table 3. Caries-risk Assessment Form for >6 Years Olds 60-62
(For Dental Providers)

<table>
<thead>
<tr>
<th>Factors</th>
<th>High Risk</th>
<th>Moderate Risk</th>
<th>Protective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biological</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient is of low socioeconomic status</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has &gt;3 between meal sugar-containing snacks or beverages per day</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has special health care needs</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Patient is a recent immigrant</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Protective</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient receives optimally-fluoridated drinking water</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient brushes teeth daily with fluoridated toothpaste</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient receives topical fluoride from health professional</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional home measures (eg, xylitol, MI paste, antimicrobial)</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has dental home/regular dental care</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Clinical Findings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has ≥1 interproximal lesions</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has active white spot lesions or enamel defects</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has low salivary flow</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient has defective restorations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient wearing an intraoral appliance</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Circling those conditions that apply to a specific patient helps the practitioner and patient/parent understand the factors that contribute to or protect from caries. Risk assessment categorization of low, moderate, or high is based on preponderance of factors for the individual. However, clinical judgment may justify the use of one factor (eg, >1 interproximal lesions, low salivary flow) in determining overall risk.

Overall assessment of the dental caries risk: High ☐️ Moderate ☐️ Low ☐️
<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Diagnostics</th>
<th>Fluoride</th>
<th>Diet</th>
<th>Sealants (\alpha)</th>
<th>Restorative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td>- Recall every 6-12 months</td>
<td>- Twice daily brushing with fluoridated toothpaste(\beta)</td>
<td>No</td>
<td>Yes</td>
<td>- Surveillance(\gamma)</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>- Recall every 6 months</td>
<td>- Twice daily brushing with fluoridated toothpaste(\beta)</td>
<td>Counseling</td>
<td>Yes</td>
<td>- Active surveillance(\epsilon) of incipient lesions</td>
</tr>
<tr>
<td>patient/parent engaged</td>
<td>- Radiographs every 6-12 months</td>
<td>- Fluoride supplements(\delta)</td>
<td></td>
<td></td>
<td>- Restoration of cavitated or enlarging lesions</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>- Recall every 6 months</td>
<td>- Professional topical treatment every 6 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>patient/parent not engaged</td>
<td>- Radiographs every 6-12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td>- Recall every 3 months</td>
<td>- Brushing with 0.5% fluoride</td>
<td>Counseling,</td>
<td>Yes</td>
<td>- Active surveillance(\epsilon) of incipient lesions</td>
</tr>
<tr>
<td>patient/parent engaged</td>
<td>- Radiographs every 6 months</td>
<td>- Fluoride supplements(\delta)</td>
<td>with limited</td>
<td></td>
<td>- Restoration of cavitated or enlarging lesions</td>
</tr>
<tr>
<td>High risk</td>
<td>- Recall every 3 months</td>
<td>- Professional topical treatment every 3 months</td>
<td>Xylitol</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>patient/parent not engaged</td>
<td>- Radiographs every 6 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legends for Tables 4-6**

\(\alpha\) Salivary mutans streptococci bacterial levels.

\(\beta\) Twice daily brushing with fluoridated toothpaste.

\(\delta\) Fluoride supplements.

\(\gamma\) Professional topical treatment.

\(\epsilon\) Active surveillance of incipient lesions.

\(\theta\) Interim Therapeutic Restoration.

\(\chi\) Periodic monitoring for signs of caries progression.

\(\gamma\) Parental supervision of a “pea sized” amount of toothpaste.
American Dental Association:

Caries-risk Assessment Form
(revised 2011)

2 caries risk assessment forms, no management protocols:
age 0-6
age >6
# Caries Risk Assessment Form (Age >6)

<table>
<thead>
<tr>
<th>Contributing Conditions</th>
<th>Check or circle the conditions that apply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Fluoride Exposure</strong> (through drinking water, supplements, professional applications, toothpaste)</td>
<td>Low Risk</td>
</tr>
<tr>
<td><strong>2. Sugary Foods or Drinks</strong> (including juice, carbonated or non-carbonated soft drinks, energy drinks, medicinal syrup)</td>
<td>Primarily at mealtimes</td>
</tr>
<tr>
<td><strong>3. Caries Experience of Mother, Caregiver and/or other Siblings</strong> (for patients ages 0-14)</td>
<td>No carious lesions in last 24 months</td>
</tr>
<tr>
<td><strong>4. Dental Home established patient of record, receiving regular dental care in a dental office</strong></td>
<td>Yes</td>
</tr>
</tbody>
</table>

## General Health Conditions

<table>
<thead>
<tr>
<th>Check or circle the conditions that apply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Special Health Care Needs</strong> (developmental, physical, medical or mental disabilities that prevent or limit performance of adequate oral health care by themselves or caregivers)</td>
</tr>
<tr>
<td><strong>2. Chemo/Radiation Therapy</strong></td>
</tr>
<tr>
<td><strong>3. Eating Disorders</strong></td>
</tr>
<tr>
<td><strong>4. Medications that Reduce Salivary Flow</strong></td>
</tr>
<tr>
<td><strong>5. Drug/Alcohol Abuse</strong></td>
</tr>
</tbody>
</table>

## Clinical Conditions

<table>
<thead>
<tr>
<th>Check or circle the conditions that apply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Cavitated or Non-Cavitated (inceptive) Carious Lesions or Restorations (visually or radiographically evident)</strong></td>
</tr>
<tr>
<td><strong>2. Teeth Missing Due to Caries in past 36 months</strong></td>
</tr>
<tr>
<td><strong>3. Visible Plaque</strong></td>
</tr>
<tr>
<td><strong>4. Unusual Tooth Morphology that compromises oral hygiene</strong></td>
</tr>
<tr>
<td><strong>5. Interproximal Restorations - 1 or more</strong></td>
</tr>
<tr>
<td><strong>6. Exposed Root Surfaces Present</strong></td>
</tr>
<tr>
<td><strong>7. Restorations with Overhangs and/or Open Margins: Open Contacts with Food Impaction</strong></td>
</tr>
<tr>
<td><strong>8. Dental/Orthodontic Appliances (fixed or removable)</strong></td>
</tr>
<tr>
<td><strong>9. Severe Dry Mouth (Xerostomia)</strong></td>
</tr>
</tbody>
</table>

## Overall assessment of dental caries risk:

- Low
- Moderate
- High

**Patient instructions:**
Caries Risk Assessment

Caries Management by Risk Assessment
(CAMBRA)
(revised 2007)

2 caries risk assessment forms,
Detailed suggested management protocols:
age 0-6
age >6
### Caries Risk Assessment Form — Children Age 6 and Over/Adults

**Assessment Date:** Please circle **baseline** or **recall**

<table>
<thead>
<tr>
<th>Disease Indicators (Any one “YES” signifies likely “High Risk” and to do a bacteria test***)</th>
<th>YES - CIRCLE</th>
<th>YES - CIRCLE</th>
<th>YES - CIRCLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible cavities or radiographic penetration of the dentin</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiographic approximal enamel lesions (not in dentin)</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White spots on smooth surfaces</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restorations last 3 years</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Risk Factors (Biological predisposing factors) | YES | | |
|---|---|---|
| MS and L. B. both medium or high (by culture***) | YES | | |
| Visible heavy plaque on tooth | YES | | |
| Frequent snack (> 3x daily between meals) | YES | | |
| Deep pits and fissures | YES | | |
| Recreational drug use | YES | | |
| Inadequate saliva flow by observation or measurement (***If measured, note the flow rate below) | YES | | |
| Saliva reducing factors (medications/radiatory/systemic) | YES | | |
| Exposed roots | YES | | |
| Orthodontic appliances | YES | | |

| Protective Factors | YES | | |
|---|---|---|
| Lives/work/school fluoridated community | YES | | |
| Fluoride toothpaste at least once daily | YES | | |
| Fluoride toothpaste at least 2x daily | YES | | |
| Fluoride mouthrinse (0.05% NaF) daily | YES | | |
| 5,000 ppm F. fluoride toothpaste daily | YES | | |
| Fluoride varnish in last 6 months | YES | | |
| Office F topical in last 6 months | YES | | |
| Chlorhexidine prescribed/used one week each of last 6 months | YES | | |
| Xylitol gums/lozenges 4x daily last 6 months | YES | | |
| Calcium and phosphate paste during last 6 months | YES | | |
| Adequate saliva flow (> 1 ml/min stimulated) | YES | | |

---

**Bacteria/Saliva Test Results:** MS: LB: Flow Rate: ml/min. Date:

---

**Visualize Caries Balance:**

(Use circled indicators/factors above)

**EXTREME RISK** — HIGH RISK + SEVERE SALIVARY GLAND HYPOFUNCTION

Caries Risk Assessment (CIRCLE): EXTREME HIGH MODERATE LOW

---

**Doctor Signature:**

---

**Date:**
<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Frequency of Radiographs</th>
<th>Frequency of Caries Recall Exams</th>
<th>Saliva Test (Saliva Flow &amp; Bacterial Culture)</th>
<th>Antibacterials</th>
<th>Fluoride</th>
<th>pH Control</th>
<th>Calcium &amp; Phosphate Topical Supplements</th>
<th>Sealants (Resin-based or Glass Ionomer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td>Bitemonthly radiographs every 24-36 months</td>
<td>Every 6-12 months to re-evaluate caries risk</td>
<td>Maybe done as a baseline reference for new patients</td>
<td>Per saliva test if done</td>
<td>OTC fluoride-containing toothpaste twice daily, after breakfast and at bedtime. Optional: NaF varnish if excessive root exposure or sensitivity</td>
<td>Not required</td>
<td>Not required</td>
<td>Optional or as per ICDAS sealant protocol (Table 2)</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>Bitemonthly radiographs every 18-24 months</td>
<td>Every 4-6 months to re-evaluate caries risk</td>
<td>Per saliva test if done</td>
<td>Xylitol (16-10 grams/day) gum or candy. Two tabs of gum or two candies four times daily</td>
<td>OTC fluoride-containing toothpaste twice daily plus: 0.05% NaF rinse daily. Initially, 1-2 app of NaF varnish; 1 app at 3-6 month recall</td>
<td>Not required</td>
<td>Not required</td>
<td>Optional; for excessive root exposure or sensitivity</td>
</tr>
<tr>
<td>High risk*</td>
<td>Bitemonthly radiographs every 1-18 months or until no cavitated lesions are evident</td>
<td>Every 3-4 months to re-evaluate caries risk and apply fluoride varnish</td>
<td>Chlorhexidine gluconate 0.2%, 10 ml rinse for one minute daily for one week each month. Xylitol (8-10 grams/day) gum or candy. Two tabs of gum or two candies four times daily</td>
<td>1.1% NaF toothpaste twice daily instead of regular fluoride toothpaste. Options: 0.29% NaF rinse daily to 0.2% NaF rinse daily (in bottle) then OTC 0.05% NaF rinses twice daily. Initially, 1-3 app of NaF varnish; 1 app at 3-4 month recall</td>
<td>Not required</td>
<td>Not required</td>
<td>Apply calcium/phosphate paste several times weekly (Table 2)</td>
<td></td>
</tr>
<tr>
<td>Extreme risk*** (High risk plus dry mouth or special needs)</td>
<td>Bitemonthly radiographs every 1-6 months or until no cavitated lesions are evident</td>
<td>Every 3 months to re-evaluate caries risk and apply fluoride varnish</td>
<td>Chlorhexidine gluconate 0.12% (preferably 0.2%) in water base rinse. 10 ml rinse for one minute daily for one week each month. Xylitol (8-10 grams/day) gum or candy. Two tabs of gum or two candies four times daily</td>
<td>1.1% NaF toothpaste twice daily instead of regular fluoride toothpaste. OTC 0.05% NaF rinse when mouth feels dry after snacking, breakfast, and lunch. Initially, 1-3 app. NaF varnish; 1 app at 3 month recall</td>
<td>Acid-neutralizing rinses as needed. If mouth feels dry after snacking, bedtime and for breakfast. Baking soda rinse as needed</td>
<td>Required Apply calcium/phosphate paste twice daily</td>
<td>As per ICDAS sealant protocol (Table 2)</td>
<td></td>
</tr>
</tbody>
</table>

*Patients with one or more caries lesion(s) are high-risk patients. **Patients with one or more caries lesion(s) and severe hypersalivation are extreme-risk patients. ***All restorative work to be done with glass ionomer materials until caries progression is controlled. Patients with appliances (RBGs, prosthetics) require prophylactic oral care to maintain intensive fluoride therapy e.g. high fluoride toothpaste and fluoride varnish every three months. Where indicated, antibacterial therapy to be done in conjunction with restorative work. ****For all risk levels: Patients must maintain good oral hygiene and a diet low in sugar.
Caries Risk Assessment

Cariogram
(version 3.0)

PC-based caries risk assessment program, with general management suggestions:

for all ages
The Cariogram indicates a Very high risk for caries. Urgent actions are needed.

Consider all parameters where score 2 or 3 have been added in the boxes - which of them can most easily be changed to the better? Examples of actions in this case are:

* The Diet situation with respect to both content of fermentable carbohydrates and frequency of eating is a clear problem - a much better "dietary discipline" is needed.

* The Bacterial situation with respect to both plaque amount and Mutans streptococci level has a heavy impact - both factors should be urgently controlled. Improved oral hygiene and repeated professional tooth cleaning is advised. For an effective reduction of the mutans streptococci, a Chlorhexidine gel treatment session is recommended.

* Due to the high caries risk, a reinforced Fluoride program in addition to the fluoride toothpaste is encouraged.
<table>
<thead>
<tr>
<th>System</th>
<th>number of risk factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>child</td>
<td>adult</td>
</tr>
<tr>
<td>AAPD</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>ADA</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>CAMBRA</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Cariogram</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>
## Comparison among Systems

<table>
<thead>
<tr>
<th></th>
<th>Number of micro/salivary factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAPD</td>
<td>0 (Child) 1 (Adult)</td>
</tr>
<tr>
<td>ADA</td>
<td>1 (Child) 1 (Adult)</td>
</tr>
<tr>
<td>CAMBRA</td>
<td>2* (Child) 3 (Adult)</td>
</tr>
<tr>
<td>Cariogram</td>
<td>3* (Child) 3* (Adult)</td>
</tr>
</tbody>
</table>
# Caries Risk Assessment

## Comparison among Systems

<table>
<thead>
<tr>
<th>System</th>
<th>number of risk categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAPD</td>
<td>child: 3, adult: 3</td>
</tr>
<tr>
<td>ADA</td>
<td>child: 3, adult: 3</td>
</tr>
<tr>
<td>CAMBRA</td>
<td>child: 4, adult: 4</td>
</tr>
<tr>
<td>Cariogram</td>
<td>child: %, adult: %</td>
</tr>
</tbody>
</table>
# Caries Risk Assessment

## Comparison among Systems

<table>
<thead>
<tr>
<th></th>
<th><strong>Child</strong></th>
<th><strong>Adult</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAPD</strong></td>
<td></td>
<td><strong>F supplements</strong>*</td>
</tr>
<tr>
<td></td>
<td>6 month office F</td>
<td>6 month office F</td>
</tr>
<tr>
<td></td>
<td><strong>sealants</strong>*</td>
<td><strong>sealants</strong></td>
</tr>
<tr>
<td><strong>ADA</strong></td>
<td><strong>----</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>salivary test</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>office F</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>xylitol</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CAMBRA</strong></td>
<td></td>
<td><strong>F varnish</strong></td>
</tr>
<tr>
<td></td>
<td><strong>chlorhexidine tx</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>reinforced F</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Caries Risk Assessment

### Comparison among Systems

#### Behavioral recommendations for moderate risk

<table>
<thead>
<tr>
<th></th>
<th>Child</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AAPD</strong></td>
<td>dietary counseling</td>
<td>dietary counseling</td>
</tr>
<tr>
<td><strong>ADA</strong></td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>CAMBRA</strong></td>
<td>anticipatory guidance</td>
<td>OHI</td>
</tr>
<tr>
<td></td>
<td>parent commitment</td>
<td>dietary counseling</td>
</tr>
<tr>
<td></td>
<td>to individual goals</td>
<td></td>
</tr>
<tr>
<td><strong>Cariogram</strong></td>
<td>dietary counseling</td>
<td>dietary counseling</td>
</tr>
</tbody>
</table>
Lessons Learned
Validation of a Simple Approach to Caries Risk Assessment

James D. Bader, DDS, MPH; Nancy A. Perrin, PhD; Gerardo Maupome, BDS, MS, PhD; Brad Rindal, DDS; William A. Rush, PhD

Abstract

Objective: This study examined the predictive validity of a simple subjective method promoted to dentists for assessing their patients' caries risk. Methods: Data from two large group practices that have used guideline-assisted caries risk assessment (CRA) for several years were analyzed retrospectively to determine the receipt of caries-related treatment following a CRA. Patient age and receipt of caries preventive treatment subsequent to the CRA were control variables in logistic regressions to determine the likelihood of caries-related treatment for low, moderate, and high risk groups. Results: Among 45,693 individuals in the two plans, those categorized as being at high caries risk were approximately four times as likely to receive any caries-related treatment as those categorized as being at low caries risk. Those categorized as at moderate risk were approximately twice as likely to receive any treatment. In addition, for those at elevated risk who required any treatment, the number of teeth requiring treatment was larger. Conclusion: The results of this study provide the first large-scale, generalizable evidence for the validity of dentists' subjective assessment of caries risk.

Key Words: dental caries; caries risk assessment; dental caries incidence; dentist practice patterns

Introduction

Methods to assess the likelihood that an individual would develop one called for an extensive variety of inputs, typically requiring salivary flow rates, mutans and/or lactobacilli counts, and formal diet histories in addition to results of clinical examinations of the teeth. All required arithmetic operations to produce a categorization score.

Until recently, none of the caries risk assessment systems described in the literature had been validated in clinical practice. In this context, validation means that the accuracy of the caries risk categorizations made at baseline are compared to actual caries experience determined through one or more follow-up examinations in a population other than that used to develop the predictive formula. Within the past few years, validation studies have been reported for two computational systems, the
Caries Risk Assessment

Lessons Learned

Retrospective study in two large group practices: n=45,000 patients

After risk level determination: 6 months washout
  2 years caries Tx

High risk patients 4 times as likely to receive subsequent caries-related treatment

Moderate-risk patients 2 times as likely to receive subsequent caries-related treatment
## Lessons Learned

Mean Percent of Dentists’ Patients Receiving Fluoride Following the CRA, by Risk Level

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan A</td>
<td>10%</td>
<td>64%</td>
<td>64%</td>
</tr>
<tr>
<td>Plan B</td>
<td>37%</td>
<td>42%</td>
<td>41%</td>
</tr>
</tbody>
</table>
A pilot study of risk-based prevention in private practice


Risk-based prevention has been promoted in recent years as a method of directing the appropriate type and amount of preventive services to patients. Risk-based prevention of caries and periodontal disease is an important component of evidence-based dentistry, which has been shown to reduce costs of care and improve patient outcomes. The purpose of this study was to evaluate the feasibility of risk-based prevention in private practice. A pilot study was conducted in 15 private dental practices. Volunteer clinicians participated in a six-month pilot study to test methods for a larger, risk-based prevention demonstration study operated by a dental insurer. Concomitant with oral examinations for patients of this insurer, clinicians identified patients at elevated risk of developing dental caries and periodontal disease. For these patients, the reasons for elevated risk (risk indicators), as well as planned preventive treatment in response to that risk, were recorded and transmitted to the insurer via a claim form. The clinicians identified relatively small percentages of patients as being at high risk of developing caries (4 percent) and periodontal disease (7 percent), with little variation across the 15 offices. Larger proportions of patients were identified as being at moderate risk of developing caries

Background. Risk-based prevention is a means of ensuring that patients receive preventive treatment appropriate for their risk of disease. While straightforward, its application in private practice has not been examined.

Methods. Volunteer clinicians in 15 offices participated in a six-month pilot study to test methods for a larger, risk-based prevention demonstration study operated by a dental insurer. Concomitant with oral examinations for patients of this insurer, clinicians identified patients at elevated risk of developing dental caries and periodontal disease. For these patients, the reasons for elevated risk (risk indicators), as well as planned preventive treatment in response to that risk, were recorded and transmitted to the insurer via the claim form.

Results. The clinicians identified relatively small percentages of patients as being at high risk of developing caries (4 percent) and periodontal therapy (7 percent), with little variation across the 15 offices. Larger proportions of patients were identified as being at moderate risk of developing caries and periodontal disease.
Lessons Learned

Small study: 15 practices

sponsored by insurance carrier

dentists record:

risk level of carrier’s patients

reasons for risk

planned preventive treatment
# Caries Risk Assessment
(circle all to be entered)

<table>
<thead>
<tr>
<th>Risk Level (circle 1)</th>
<th>Risk Indicators (circle up to 3)</th>
<th>Preventive Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CH</strong> High</td>
<td>A Poor oral hygiene</td>
<td>N Topical fluoride</td>
</tr>
<tr>
<td><strong>CM</strong> Moderate</td>
<td>B Multiple carious lesions</td>
<td>O Fluoride varnish</td>
</tr>
<tr>
<td><strong>CL</strong> Low</td>
<td>D Multiple restorations</td>
<td>Q OTC fluoride rinse</td>
</tr>
<tr>
<td></td>
<td>E Fluoride status</td>
<td>R_x fluoride dentifrice</td>
</tr>
<tr>
<td></td>
<td>F Low salivary flow</td>
<td>S Calcium phosphate</td>
</tr>
<tr>
<td></td>
<td>G Exposed root surfaces</td>
<td>T_x antimicrobial medication</td>
</tr>
<tr>
<td></td>
<td>I Orthodontic brackets</td>
<td>U Oral hygiene/diet counseling</td>
</tr>
<tr>
<td></td>
<td>J Elevated <em>S. mutans</em></td>
<td>V More frequent prophylaxis</td>
</tr>
<tr>
<td></td>
<td>K Other</td>
<td>W Other</td>
</tr>
</tbody>
</table>
Lessons Learned

Small percent of patients assessed at high risk:  4%
Less than one third are moderate risk:                 29%
Risk factors:       #1 multiple restorations
                    #2 multiple caries lesions
                    #3 poor oral hygiene
Treatment:   #1 OHI/dietary counseling
                #2 topical fluoride
                #3 more frequent prophy/recall
Lessons Learned

Percent of elevated risk patients with caries lesions who were planned to receive fluoride treatment: 51%

Percent of elevated risk patients with poor oral hygiene who were planned to receive OHI/prophy: 73%
Caries Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease”

*CDC
Caries Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease*”

*CDC
Caries Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease*
Caries Risk Assessment

“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease*”

*CDC
Topic # 3
Suspicious Occlusal Caries Lesions
Suspicious Occlusal Caries Lesions

How would you treat the tooth shown above?
How would you treat the tooth shown above?

- No treatment or further diagnostic testing: 29%
- Preventive treatment only: 20%
- Minimally invasive tx +/- preventive: 35%
- Restoration +/- preventive: 14%
- Other: 1%
Suspicious Occlusal Caries Lesions

SOCLs > uncertainty, variation in Tx decisions
Study 1: Study Design*

82 dentists

100 consecutive patients with at least 1 unrestored occlusal surface

- what was the prevalence of SOCLs?
- what were their characteristics?
- how were they treated?

*Makhija, 2012
Consecutive Patient Log

Data form to be filled out at time of definitive treatment decision.
Unrestored surfaces have no sealants or restorations.
Log the first 100 consecutive patients in your office toward the goal of 25 enrolled questionable lesions.
If you have not reached 25 enrolled in the first 100 patients, log enrolled questionable lesions only until the goal of 25 has been met.
Up to 2 lesions per patient can be enrolled.

<table>
<thead>
<tr>
<th>Patient Count</th>
<th>How many unrestored occlusal surfaces does this patient have? (0-20)</th>
<th>Of these, how many are questionable lesions? (0-20)</th>
<th>Completed Data Form</th>
<th>Enrolled Questionable Lesion Count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>IF 0, STOP HERE</strong></td>
<td></td>
<td>Circle Y or N</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
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Study 1: Results*

**prevalence:**
34% of patients (*with 1+ surfaces at risk*)
10% of at-risk teeth

**characteristics:**
85% dark color (*versus light*)
55% smooth (*versus rough*)
51% shiny (*versus chalky*)
52% mandibular (*versus maxillary*)
69% molar (*versus premolar*)

*Makhija, 2012*
Study 1: Results*

treatment:

70% monitor
16% sealant
14% restoration

18% no lesion
10% inactive lesion
72% active lesion

29% enamel
71% dentin

*Makhija, 2012
Study 2: Study Design

53 dentists

1341 SOCLs (at baseline)

20 Month Outcomes
- monitored
- sealed
- restored

*Makhija, 2014*
Study 2: Results*

outcomes of monitored lesions
90% continue to monitor
6% seal
4% restore

outcomes of sealed lesions
6% re-seal

outcomes of restored lesions
4% re-restore

*Makhija, 2012
To Sum Up ..........

- SOCLs are prevalent (1/3 of patients had at least one)
- Nearly half of the lesions that were opened did not extend into dentin, or were inactive or not present
- Left alone, a great majority of these lesions did not progress in 20 months

We need to develop methods to more accurately identify suspicious lesions extending into dentin
Decision Aids for the Management of Suspicious Occlusal Caries Lesions

DIAGNOdent Spectra
DIAGNOdent®

- Wavelength 655 nm
- Clean healthy tooth structure exhibits little fluorescence
  0 – 10 healthy
- Carious tooth structure exhibits fluorescence
  11 – 20 outer half enamel
  21 – 30 inner half enamel
  30+ dentin caries
Spectra®

- Uses fluorescence to detect caries in fissure and smooth surfaces
- Caries regions appear red, healthy enamel appears green
- Can also be used during the restorative phase to verify that all caries have been removed
The Issue

• Marketing emphasizes devices’ ability to detect early caries

• Crucial ability is to differentiate between enamel and dentinal caries

• Research to-date indicates good ability to detect dentinal lesions, but with lots of false positives

*Bader, 2004
Tooth Decay Detected by Laser and Light Systems

Devices Find Signs of Decay Earlier Than X-Rays, but There’s a Risk of False Positives
Tooth Decay Detected by Laser and Light Systems

Devices Find Signs of Decay Earlier Than X-Rays, but There’s a Risk of False Positives
Study 3: Study Design

Questions to be Answered

• **Primary**
  ▪ Does use of a device result in more or fewer lesions being treated surgically?
  ▪ Among lesions treated surgically, does the proportion extending into dentin increase or decrease?

• **Secondary**
  ▪ Clinician’s weighting of the visual appearance of a lesion
  ▪ Clinician’s level of confidence in the treatment decision
  ▪ Clinicians’ assessment of the utility of the caries detection devices
Study 3: Study Design

Pre-Intervention

Intervention

No Device
20 patients with SOCLs
- lesion characteristics
- treatment decision
- if opened, caries into dentin?

DIAGNOdent
20 patients with SOCLs
- lesion characteristics
- device score
- treatment decision
- if opened, caries into dentin?

Spectra
20 patients with SOCLs
- lesion characteristics
- device score
- treatment decision
- if opened, caries into dentin?

practitioner randomization & training
Participants

- **90 practitioners**--15 from each ND-PBRN region

- **40 patients/practitioner** -- 20 pre-intervention phase
  -- 20 intervention phase

- *Patients* (age ≥6 years) enrolled when SOCL identified, treatment can occur at same or subsequent appointment

- **Permanent teeth**
  - no evidence of caries into dentin based on available radiographs
  - caries into dentin is suspected, but not definitively present
  - no restoration or sealant on the occlusal surface
Thank You