Goal of this presentation

• Describe the etiology, diagnosis, and treatment of secondary caries
  – Emphasis on the diagnostic challenges
• Compare the criteria in current clinical rating systems as they relate to scoring secondary caries
  – Rgye/USPHS
  – FDI/Hickel et al.
  – ICDAS / CARS
• Make some recommendations for both clinical restorative practice and clinical evaluation of restorative materials
Some clinical decision are easy

- Obvious signs and symptoms related to condition of dental restorations
  - Most clinicians would agree on the need for treatment
  - Treatment would likely vary
Some clinical decisions are easy

- Obvious signs and symptoms related to condition of dental restoration
  - Most clinicians would agree on the need for treatment
  - Treatment would likely vary
Esthetic failures

• Esthetic failures must be handled differently
• Who decides it is a failure?
  – Patient or dentist
• Key questions to answer once an esthetic failure is called
  – Is improvement realistic?
  – Can expectations be managed?
  – Is a materials failure or operator failure?
Confusion is no short supply regarding secondary caries

• Terminology
• Diagnostic criteria
• Clinical opinion from experience
• Frequency of diagnosis
Secondary caries as cause for restoration failure

- In practice-based studies it accounts for about 50% of the reported failures of restorations (Mjör, 2005)
- In controlled clinical trials 4% to 8% over ten years (Hickel et al., 2007)
- Overused diagnosis (Mjör and Toffenetti, 2000)
Sensitivity and specificity of secondary caries diagnosis is poor

- Visual and explorer examination of restorations in extracted teeth
- Restorations removed to assess for true secondary caries
Need to reduce overtreatment

- Elderton (1990) reported inconsistencies between restorative treatment provided and what was predicted by epidemiological surveys.

<table>
<thead>
<tr>
<th>N of Dentists who Planned to Restore</th>
<th>N of Individual Tooth Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
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<tr>
<td>13</td>
<td>3</td>
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<td>12</td>
<td>5</td>
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<td>3</td>
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<tr>
<td>2</td>
<td>62</td>
</tr>
<tr>
<td>1</td>
<td>122</td>
</tr>
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</table>

The number of individual tooth surfaces planned for restoring by all 15 dentists, and the number additionally planned for restoring where 2-15 dentists were in agreement to restore.
Better to not change dentists

• Bogacki et al. 2002
  – Insurance claims data to compare survival of composite and amalgam restorations

• Changing dentist results in lower survival probability

![Graph showing survival probability over time for different dentists and different types of restorations.](image-url)
Secondary caries process

  – Mostly and outer-lesion process

• Bacteria in primary and secondary caries are similar
  – Kidd et al. (1993)

• Mostly found at gingival margins
  – Mjör (2005)
Marginal gaps and secondary caries

  – Only gaps > 400 µm resulted in increased bacteria in the underlying dentin
  – Frank carious lesions had similar levels of bacteria to wide gaps, however the *s. mutans* levels were greater

  – Concluded that imperfections in marginal integrity do not contribute to increased secondary caries risk

  – Early marginal deterioration and discoloration associated with higher failure rates
Marginal gaps and microleakage and secondary caries

• AADR 2006 symposium reviewed this topic
  – Consensus of speakers was there is not convincing evidence that links marginal gaps or microleakage as causes of secondary caries
    o Frankenberger et al.
    o Heintze
    o Sarrett
    o All in J Adhes Dent 2007:9
Prediction of secondary caries

- 79.5% of soft dentin areas were below stained margins
- But, 55.5% of hard dentin areas were also below stained margins
- Except for the presence of a frank carious lesion, none of the clinical indicators evaluated could predict the presence of soft dentin
- More bacteria were present in the marginal plaque of frank secondary caries compared with sites with no outer lesion
Operative interventions other than restoration replacement

- Clinical studies reporting on outcomes of
  - Repairing
  - Refurbishing (contouring and polishing)
  - Sealing
  - Replacement
- Generally show continued improvement in Ryge scores after two years
  - Gordon et al. (2006a and 2006b)
  - Moncada et al. (2006 & 2008)
Operative interventions other than restoration replacement

- Provides a minimally invasive approach when diagnosis is not solid (most of the time)
- For the repair option, enhances diagnosis by minimal removal of restorative material & tooth structure
Detection / assessment criteria

• Ryge / USPHS (1971)
  – Republished in 2005 in *Clin Oral Investig*

• FDI / Hickel *et al.* (2007)
  – Recommendations for conducting controlled clinical studies of dental restorative materials
  – Simultaneous publication in three sources
    ▪ *J Adhes Dent*
    ▪ *Int Dent J*
    ▪ *Clin Oral Investig*

• International Caries Detection and Assessment System (2005)
  – *www.icdas.org*
  – Work authored by a the ICDSA Coordinating Committee
  – Co-chaired by Drs. Ismail and Pitts
Table. Comparison of the Ryge/USPHS, ICDAS and FDI clinical trials criteria for assessment of secondary caries.

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**VCU Medical Center**

*David C. Sarrett, DMD, MS*
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Conclusions and Recommendations

• Terminology is confusing
  – Secondary caries
  – Recurrent caries
  – Residual caries
  – Remaining caries

• Caries Adjacent to Restorations and Sealants (CARS)
  – ICDAS term is inclusive
  – Accounts for all mechanisms for development of caries in restored teeth
Conclusions and Recommendations

- Changes in opacity or color of adjacent tooth structure are not predictive of CARS in the absence of a frankly carious gap
Conclusions and Recommendations

• CARS is most likely to be present at gingival margins
  – With greater than 400µm gap or cavity width
    ▪ Use a probe to measure defects
  – Consistent diagnosis only possible when visible soft dentin present on walls and base of lesion
Conclusions and Recommendations

• Marginal defects without visible evidence of soft dentin on the walls or base of the defect should be:
  – Monitored for change
  – Sealed
  – Or repaired
Secondary caries (CARS) or not? And does it matter?

• Or maybe the better question is when does it matter?
  – Epidemiological studies on caries prevalence
  – Clinical trials of anticariogenic materials
  – Clinical trials of materials with known potential to promote caries

• Then only count undisputable CARS based on visible presence of soft dentin
Secondary caries (CARS) or not? And does it matter?

- Should CARS be considered a reason for restorative material failure?
- What failed?
  - Tooth
  - Patient
  - Bacteria
  - Dentist
  - Saliva
And there are things that really do matter!

Thank you!