Preventing & Managing ECC using a Chronic Care Disease Management Approach

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- DentaQuest Institute
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- ECC Project Advisory Committee
- Children’s Hospital Boston’s Program for Patient Safety and Quality
- CAMBRA
Learning Objectives

- Understand:
  - That ECC is an infectious, transmissible disease common in childhood that can be prevented and managed as a chronic condition.
  - How to implement a chronic disease management approach to ECC based on the child’s changing caries risk.
  - That the Dental Team can play in identifying, preventing and managing ECC.
Epidemiology of Dental Caries in Children

- Caries is the most common **chronic** disease of childhood
  - 25% of children have 80% of disease
    - Disproportionately affects minorities and disadvantaged populations
    - Minorities and disadvantaged also have greater untreated disease

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1Surgeon General’s Report on Oral Health 2000
Caries: Implications and Consequences

- Impacts children’s function and quality of life
- Treatment imparts financial burden
- In primary teeth, predicts future decay in permanent teeth
- Yet, is a highly preventable disease
Traditional Management of ECC: Restorative treatment

- Conventional restorative treatment
  - May be difficult in young children
- Pharmacologic management
  - Nitrous oxide
  - Sedation
  - Surgical care in the OR
Traditional Management of ECC: Restorative treatment

- Restorative treatment in the OR
  - Post OR relapse rates in US: 37-79%
  - 33% required retreatment at CHB 1-2 years after OR (2003)
ECC traditional management

- Restorative treatment by itself does not address the underlying disease process (but provides stable repair of damaged tooth structures)
Opportunity for Improvement

What we do

The Gap

Desired

What we know

- Applying evidence
- Using information technology
- Aligning payment
- Preparing workforce
- Educating parents
- Changing processes
ECC Management Project*

- In two hospital settings that care for overwhelming numbers of high caries-risk and underserved children:
  - Improve quality of care
  - Improve clinical outcomes

- Methodology
  - Implement an evidence-based chronic disease management approach to manage and prevent ECC in our target populations

*Supported by grant funding from the DentaQuest Institute.
Aim and Measures

Over an 18 month period, caries will be managed and caries progression will be reduced in all children under 60 months of age who present with high risk for ECC.

Specifically, we will reduce the percent of patients who:

- Present with new Cavitation by 33%
- Experience OR treatment by 20%
- Complain of Pain on the most recent visit by 50%

We will track Cost per Case with the expectation of demonstrating savings that will lead to a sustainable business model for the program.
Timeline

- Initial conversations in late 2006
- Planning began in April 2007
- Launched in October 2007
- Practice re-design through February 2008
- Patient enrollment began in March 2008
- 18-month enrollment/intervention period
- Continuing indefinitely
Participation Criteria

- **Inclusion criteria**
  - Children less than 60 months of age
  - At least 1 carious tooth (inclusive of white spots) or prior tooth extraction due to caries

- **Exclusion criteria**
  - Children with teeth that are without adequate structural support will be excluded from interim therapeutic restoration

- Every parent of a child meeting the inclusion criteria will be invited to participate. Written informed consent required.
Evidence-Based Clinical Protocol

- **In-Clinic Care**
  - Risk assessment
    - Modified AAPD Caries Risk Assessment Tool
    - Strep Mutans testing
    - Treatment plan based on risk status (incl. periodicity of return preventive visits)
    - Fluoride varnish application
  - Restorative care (including ITR)
  - Patient education
    - Oral health literacy screening
    - Scripts

- **At-Home Self Management**
  - Gelkam (0.4% stannous fluoride) application
  - Diet modification
  - Oral hygiene
### Caries Risk Assessment/ECC Encounter

<table>
<thead>
<tr>
<th>Patient's First Name</th>
<th>Patient's Last Name</th>
<th>Today's Date</th>
<th>Child's DOB</th>
<th>Clinician's ID</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Today's Visit:</th>
<th>Is Patient ECC?</th>
<th>If yes, check:</th>
<th>Medical Management (F/U)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td>Initial (Study Enrollment)</td>
</tr>
<tr>
<td></td>
<td>New Patient Visit</td>
<td>Recall Visit</td>
<td>Scheduled Tx Visit (restorative/ART)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step mutans culture this visit?</th>
<th>Yes</th>
<th>No</th>
<th>F-Varnish Applied 1st</th>
<th>Not Enough Time</th>
<th>On Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM Levels:</td>
<td>Zero</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>V High</td>
</tr>
</tbody>
</table>

### History

<table>
<thead>
<tr>
<th>SHCN</th>
<th>Pre-natal hx/pre-term</th>
<th>On Meds</th>
<th>Breast/Bottle</th>
<th>Other</th>
<th>Caries Risk Status:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Breast/Bottle</td>
<td>No</td>
<td>High</td>
</tr>
</tbody>
</table>

### Caries History

<table>
<thead>
<tr>
<th>Child</th>
<th>Mother</th>
<th>Siblings</th>
<th>Caries Risk Status:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
</tr>
</tbody>
</table>

### Clinical Evaluation

<table>
<thead>
<tr>
<th>Visible plaque</th>
<th>Gingivitis</th>
<th>Existing Cavitated lesion</th>
<th>NEW cavitated lesions</th>
<th>Existing Demin enamel</th>
<th>NEW Demineralized enamel</th>
<th>Enamel defects</th>
<th>Deep pits / fissures</th>
<th>Other</th>
<th>Existing Remin. surfaces</th>
<th>NEW Remin. surfaces</th>
<th>Caries Risk Status:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes, complete</td>
<td>High</td>
</tr>
</tbody>
</table>

### Diet

- Frequent sugary foods/drinks: No | Yes | SW
- Sippy cup w/ juice/milk: No | Yes | SW
- Bottle use w/ milk/juice: No | Yes | SW
- On-demand breastfeeding: No | Yes | SW
- Caries Risk Status: High | Medium | Low

### Fluoride / Home care

- F-toothpaste: No | Yes
- Fluoride in drinking H2O: No | Yes
- Suppl F (GelKam, Prevenid, ACT): No | Yes
- Daily Use: 1x | 2x | 3x
- Assistance w/ brushing: No | Yes
- Floss: No | Yes | N/A
- Caries Risk Status: High | Medium | Low

### Comments:

- Franki: 1 | 2 | 3 | 4

### Supplemental Assessment

- Pain: No | Yes
- Sensitivity: No | Yes
- Radiographic caries: No | Yes | N/A
- New radiographic caries: No | Yes | N/A

### Overall Risk (before SM test)

- Very Low | Low | Medium | High

### Overall Risk (after SM test)

- Very Low | Low | Medium | High

### Care Provided Today:

- SM Test | Self-mgmt edu given | OH Literacy | F-Varnish | Recomended GelKam: 1x | 2x | ART | Conventional Restorative | OR

### Tx Plan: Fluoride

- One month | Three months | Six months

### Restorative

- None -> monitor | Conventional restoration | ART | OR

### Next Visit:

- One month | Three months | Six months
Legend:
1 = Demineralized enamel (white spot)
2 = Cavitation into enamel/dentin
3 = Cavitation into pulp
C = Soft decay
B = Somewhat remineralized; slightly soft
A = Completely remineralized (arrested)

Each surface will be marked ___,
Examples:
2,B = cavitation into dentin with slight softness
Evidence-Based Protocol of Care

- At-Home Self Management
  - Gelkam (0.4% stannous fluoride) application
  - Diet modification
  - Oral hygiene

- Self-management Goals for Caregivers
Self Management Goals for Caregivers

Patient Name: ___________________    DOV: ___________________

Your child has been assessed to have the following risk for caries (cavities):

☐ High    ☐ Moderate    ☐ Low

The pictures checked are the areas you should focus on between today and your next visit:

☐ Next fluoride visit in ___ months

☐ Healthy snacks
☐ Go soda
☐ Juice only with meals

☐ Only water/unsweetened milk in bottle
☐ Go sippy cup or only water in cup
☐ Daily flossing
☐ Brush twice with thin layer of fluoride toothpaste

☐ If bottle in bed, use only water

☐ Drink fluoridated water
☐ Less or no candy
☐ Use toothpaste ___ a day

Clinician’s Comments:

Copyright 2004 Child Life Media
Almost all foods have the potential to produce decay. Decreasing the frequency of food and beverages consumption can help to reduce the potential for cavities. We recommend three meals a day and two healthy snacks.

In addition, certain foods have less potential to produce decay. The following is a list of snack foods that is a guide relative to their decay causing potential. Note that sugar alone is not the only variable affecting the decay process, but also the retentiveness of the food to the tooth surface.

<table>
<thead>
<tr>
<th>High Decay Potential</th>
<th>Moderate Decay Potential</th>
<th>Low Decay Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cookies</td>
<td>Bananas</td>
<td>Dark Chocolate</td>
</tr>
<tr>
<td>Crackers</td>
<td>Sweetened Yogurt</td>
<td>Apples</td>
</tr>
<tr>
<td>Dried foods and fruit snacks</td>
<td>Milk chocolate</td>
<td>Milk</td>
</tr>
<tr>
<td>Cake and Candy</td>
<td>Potato chips</td>
<td>Sugar free gum</td>
</tr>
<tr>
<td>Bread</td>
<td>Pretzels</td>
<td>Sugar free hard candy</td>
</tr>
<tr>
<td>Sugar cereals</td>
<td>Ice cream</td>
<td>Plain yogurt</td>
</tr>
<tr>
<td>Sodas</td>
<td>Cheese doodles/Cheese-Its</td>
<td>Nuts</td>
</tr>
<tr>
<td>Juice</td>
<td></td>
<td>Natural Cheese</td>
</tr>
<tr>
<td>Sports drinks – gatorade, poweraid</td>
<td></td>
<td>Vegetables</td>
</tr>
<tr>
<td>Fermentable carbohydrates:</td>
<td></td>
<td>Popcorn</td>
</tr>
<tr>
<td>Sucrose, glucose, fructose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HOW MUCH SUGAR IS YOUR CHILD DRINKING?

One 12 oz can
Around 23 grams or 3 tsp of sugar in one 12 oz serving

One 8 oz serving
Around 25 grams or 3 tsp of sugar in one 8 oz serving

One 12 oz serving
Around 39 grams of sugar or 8 tsp in one 12 oz can
Preliminary Results

- As of September 2010 (after 30 months of subject enrollment)
- 764 patients enrolled
  - 481 (CHB): 401 active; 80 inactive
  - 283 (SJH): 165 active; 118 inactive
- Number of patients who have at least 2 visits
  - CHB= 372
  - SJH= 236
## Preliminary Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>Children’s Hospital</th>
<th>St. Joseph Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>New cavitation</td>
<td>26.1% (97/372)</td>
<td>40.7% (96/236)</td>
</tr>
<tr>
<td>Pain</td>
<td>12.1% (45/372)</td>
<td>7.2% (17/236)</td>
</tr>
<tr>
<td>Referred to OR (not first visit)</td>
<td>9.7% (36/372)</td>
<td>14.8% (35/236)</td>
</tr>
</tbody>
</table>
Preliminary Results

- **Site:** Children’s Hospital Boston
- **Time period:** 4/2008 through 9/2010
- **Number of Patients with at least 2 visits:** N=372
  - Mean number of visits: 5.1 (Median: 5)
  - Mean time in study (days): 357.3 (Median: 364)
  - Mean visit rate (visits/year): 8.2 (Median: 5.6)
  - New Cavity: 26.1% (N=97)
  - Referred to OR: 9.7% (N=36)
  - Pain at Visit: 12.1% (N=45)
  - New Remineralization: 41.4% (N=154)
  - Risk Downgrade*: 51.1% (N=153)

*From High Risk at first visit (N=300) to Medium/Low Risk at last visit*
Overall Risk Level by Visit Number

The proportion of high risk patients decline with consecutive visits.
Comparing ECC to Historical Baseline

**Historical Control Group (N=130)**
- Minimum of 2 visits per patient
- Inclusion criteria:
  - <5 years at first visit
  - 80 months of age cut off for follow up
  - Healthy
  - At risk (1 cavity currently or in the past)

**ECC Group (N=372)**
- Time Frame 4/2008 through 10/2010
- Same as above

*Site: Children’s Hospital Boston*
### Covariates by Group

<table>
<thead>
<tr>
<th></th>
<th>Total Patients (N)</th>
<th>Event (N)</th>
<th>Rate (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English Primary Language</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>363</td>
<td>249</td>
<td>68.6%</td>
<td>0.005</td>
</tr>
<tr>
<td>Control</td>
<td>117</td>
<td>96</td>
<td>82.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Age under 4 yrs at first visit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>371</td>
<td>295</td>
<td>79.5%</td>
<td>NS</td>
</tr>
<tr>
<td>Control</td>
<td>127</td>
<td>94</td>
<td>74.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Public Insurance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>366</td>
<td>286</td>
<td>78.1%</td>
<td>NS</td>
</tr>
<tr>
<td>Control</td>
<td>121</td>
<td>87</td>
<td>71.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Mean Visits per year</strong></td>
<td></td>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>365</td>
<td>8.63</td>
<td>8.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Control</td>
<td>124</td>
<td>4.78</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td><strong>Time in study (days)</strong></td>
<td></td>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>365</td>
<td>357.3</td>
<td>240.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Control</td>
<td>130</td>
<td>561.8</td>
<td>277.8</td>
<td></td>
</tr>
<tr>
<td><strong>Age (years) at first visit</strong></td>
<td></td>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>364</td>
<td>3.18</td>
<td>0.98</td>
<td>NS</td>
</tr>
<tr>
<td>Control</td>
<td>127</td>
<td>3.24</td>
<td>0.91</td>
<td></td>
</tr>
</tbody>
</table>

- ECC N=372
- Control N=130
## ECC vs Baseline*

<table>
<thead>
<tr>
<th>Measure</th>
<th>ECC</th>
<th>Historical Control</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Cavitation</td>
<td>26.1% (97/372)</td>
<td>72% (93/130)</td>
<td>33% of 72%= 48%</td>
</tr>
<tr>
<td>Pain</td>
<td>12.1% (45/372)</td>
<td>20% (26/130)</td>
<td>50% of 20%= 10%</td>
</tr>
<tr>
<td>Referred to OR (not first visit)</td>
<td>9.7% (36/372)</td>
<td>20% (26/130)</td>
<td>20% of 20%= 16%</td>
</tr>
</tbody>
</table>

*Children’s Hospital Boston  
**Patients with at least 2 visits included
Survival Analysis: Time to New Cavitation

Hazard Ratio: 0.397 $p < 0.001$

At 368 days follow up, 50% of Controls had a new cavity compared to only 27% of ECC group.

Mean days to New Cavitation: Control= 400 days/ ECC= 643 days
Qualitative Observations

- Patients have returned with:
  - Complete re-mineralization and improvement of oral health
  - No re-mineralization, and no improvement
  - Partial re-mineralization and new decay occurring at the same time

- Multiple visits do not = improvement
  - Caregiver management is key
ECC Patient #1
ECC Patient #3
Interviews with ECC Project Parents

- Qualitative study of parents’ perceptions and expectations
- Key emerging themes were identified
  - Parents knowledge and perceptions of oral health
  - Guilt and frustrations
  - Family and social influences
  - Parent/provider interactions
The Challenges of Change...

Making the Pieces Fit
Lessons Learned So Far

Effective ECC management calls for a paradigm shift to a chronic disease model, which includes surgical care delivery:

- QI allows flexibility in making systems changes
- Clinicians and staff can support systems change that make sense conceptually
- Most parents are receptive to prevention and self-management goals
  - Need reinforcement and support
Improvement Continuum

Degree of belief that the changes will result in improvement

- **High**
  - 1 or 2 examples

- **Moderate**

- **Low**

- **Prototype**

- **Pilot**
  - 8 to 19 examples

- **Adapt and Spread**
  - Successful changes
  - Changes still need further testing.
  - There is a risk of moving to spread.
  - Unsuccessful proposed changes
Reduce burden of dental disease
- % pts with new cavitation
- % pts complaining of pain
- % of pts with OR Tx

Primary Drivers

P1 Active, informed families

P2 Reliable delivery of evidence based preventive & restorative care

P3 Improved patient access: ‘Dental Home’

Secondary Drivers

S1 Patient oral health literacy

S2 Patient self management
  - Improved diet
  - Improved hygiene

S3 Community support
  - CHCs, private dentists, pediatricians, PCPs
  - Payers

S4 Early, regular risk-based evaluation & guidance

S5 Use of conservative procedures
  - Fluoride exposure
  - ART

S6 Qualified OR Tx

S7 Coordination with PCPs: referrals

S8 Team-based care

S9 Balancing demand and capacity
Model for Improvement

What are we trying to accomplish?

How will we know that a change is an improvement?

What change can we make that will result in improvement?

Aim

Measures

Change

PDSA Testing Cycle

Act

Plan

Study

Do
**Improvement**

*Goal: Improve practice of health care*

- Test observable
- Stable bias
- Just enough data
- Adaptation of the changes
- Many sequential tests
- Assess by degree of belief – data over time

---

**Clinical Research**

*Goal: Create new clinical knowledge*

- Test blinded
- Eliminate bias
- Just in case data
- Fixed hypotheses
- One fixed test
- Assess by statistical significance ($p$-value)
ECC Prevention and Management

- Should be focused on
  - Chronic disease management
  - Caries risk assessment
  - Family centered care
  - Systems changes
Thank you and questions please...