In the previous issue of Oral Health Pearls, we discussed the vertical and horizontal transmission of pathologic oral flora (e.g. Streptococcus mutans) and measures you could use during routine visits to screen for associated risk factors. Once these pathologic flora colonize the oral hard and soft tissues, they are able to ferment dietary carbohydrates into acids (e.g. lactic acid) that decrease the oral pH. This acidic environment fosters the demineralization of enamel. If left unchecked, this process can progress to early childhood caries. Fluoride plays a very important role in preventing enamel demineralization.

Fluoride is a negatively charged ion that has a high affinity for calcium-containing structures. When absorbed into the enamel matrix, fluoride forms fluorapatite. Fluorapatite is more resistant to demineralization than the crystalline calcium phosphate found in teeth known as hydroxyapatite. Thus it prevents caries in the following three ways:

1. It remineralizes tooth enamel
2. It inhibits enamel demineralization
3. It also inhibits cariogenic bacteria’s acid producing abilities

American Academy of Pediatrics (AAP) policy recommends that pediatricians screen for and discuss the adequacy of patients’ fluoride intake as part of routine health maintenance exams and oral health risk assessment. Assessment should encompass a patient’s cumulative fluoride intake from all available sources and direct any necessary preventive education discussions.

**Fluoride Sources:**

**WATER**

Community water fluoridation comprises one of the most widely available fluoride sources. Water fluoridation alone reduces dental decay by 20-40%, and has been proclaimed as one of the ten great public health achievements of the 20th century. The per-person lifetime cost of community water fluoridation is less than the cost of one dental filling.

The CDC recommends fluoridated water contain 0.7 parts per million (ppm) to 1.2 ppm (0.7-1.2mg/L) of fluoride. Community water fluoridation levels vary, thus it is important to know the fluoride content of local water supplies compared to this guideline. In Illinois, almost 99% of the population has access to fluoridated drinking water. Chicago and its surrounding communities supplement fluoride at 1.0ppm. Specific information regarding fluoridation levels of other community water supplies can be found at the Center for Disease Control (CDC) website at http://apps.nccd.cdc.gov/MWF/CountyDataV.asp?State=IL.

People living in rural areas with private water wells do not have the benefits of optimal water fluoride supplementation. As wide variations in the natural fluoride concentration exist, well water should be tested by contacting the Illinois Department of Public Health’s Division of Oral Health for a free testing kit (see resources on page 16) or by using a private lab. Pediatricians should know that other water sources (Table 1) commonly consumed by children contain more variable fluoride levels, which may significantly affect caries risk.

**Table 1: Common Water Sources and their Fluoridation Levels**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>FLUORIDATION LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Commercially bottled waters</td>
<td>No or suboptimal levels (&lt;0.3ppm)</td>
</tr>
<tr>
<td>• Packaged sterile &amp; distilled water</td>
<td>No or suboptimal levels (&lt;0.3ppm)</td>
</tr>
<tr>
<td>• Nursery water</td>
<td>Supplemented at 0.7ppm (0.7mg/L)</td>
</tr>
<tr>
<td>• Home water filtration systems:</td>
<td>Remove fluoride ions</td>
</tr>
<tr>
<td>— Reverse osmosis &amp; distillation</td>
<td>Insignificant effect to fluoride content</td>
</tr>
<tr>
<td>— Activated charcoal &amp; cellulose filters (e.g. Brita®, Pur®)</td>
<td></td>
</tr>
</tbody>
</table>

Certain sterilized water sources considered by some to be safer for infant consumption similarly contain variable fluoride levels (Table 1). Nursery water should be recommended to families who prefer or need to use bottled water for infant consumption at the appropriate ages. ICAAP’s Bright Smiles from Birth (BSFB) program offers several patient education handouts that discuss bottled water, filtration systems, and fluoride testing resources at www.illinoisaap.org/?p=1119. Illinois pediatricians are welcome to adopt and incorporate these resources into their patient education library.
**FLUORIDE SUPPLEMENTATION**

The AAP, CDC, American Dental Association (ADA) recommend fluoride supplementation for infants and children six months to sixteen years according to the age, available fluoride sources, and caries risk (Table 2).

Infants who exclusively breastfeed deserve special mention as breast milk contains suboptimal fluoride concentrations. Fluoride supplementation should be prescribed for these infants (six months and older) until other dietary fluoride sources become adequate. Fluoride containing multivitamin preparations (Poly-vi-flor®, Tri-vi-flor®) are common supplemental options, which provide both vitamin D and fluoride to nursing infants.

**TOOTHPASTE**

Toothpaste is manufactured as non-fluoridated and fluoridated (1,000–1,100 ppm in the U.S.) formulations. Brushing with fluoridated toothpaste reduces caries by a median of 15%–30%, and combining fluoride toothpaste with fluoridated water has been shown to provide higher protection than the use of either product alone. Not rinsing the mouth after use of fluoridated toothpaste facilitates a temporary increase of fluoride concentration in saliva 100– to 1,000-fold. Table 3 lists age-appropriate brushing recommendations.

Your local pediatric dentist can also assist you in determining what is the optimal level of fluoridated toothpaste to recommend and can also advise as to whether the use of prescription strength fluoridated toothpastes is appropriate for those with high caries levels.

**FLUORIDE VARNISH**

Another delivery method of fluoride application is the fluoride varnish. Fluoride varnishes are used extensively in Europe and Canada as preventive intervention for dental caries and their safety and efficacy have been widely established. The Federal Drug Administration has approved fluoride varnish for other cavity related indications, yet fluoride varnish specifically used for caries prevention encompasses an off-label use in the United States.

Varnishes are a clear or honey-colored sticky resin of highly concentrated fluoride (up to 22,600 ppm) typically packaged with a brush applicator. The varnish almost instantly adheres to dried tooth enamel thereby decreasing the risk of ingestion. Their use has been shown to lead to an average reduction of caries by 33% in the primary dentition and by 46% in the permanent dentition. As such, they can be especially beneficial for high-risk populations.

Pediatricians can apply the varnish onto dried tooth enamel 3–4 times a year as part of the routine health exam for the high-risk children. ICAAP’s BSFB introduces and educates pediatricians regarding fluoride varnish and its application through a CME-approved session and provides a free starter package of fluoride varnish materials and office instructions regarding billing procedures. BSFB is reimbursable for certain Illinois populations and areas.

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**Table 2: Recommended Fluoride Supplementation**

<table>
<thead>
<tr>
<th>AGE</th>
<th>FLUORIDE CONCENTRATION IN DRINKING WATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.3PPM</td>
<td>None</td>
</tr>
<tr>
<td>0.3 – 0.6PPM</td>
<td>0.25mg / day</td>
</tr>
<tr>
<td>&gt; 0.6PPM</td>
<td>0.5mg / day</td>
</tr>
</tbody>
</table>

**Table 3: Brushing and Toothpaste Recommendations Based on Age and Caries Risk**

<table>
<thead>
<tr>
<th>AGE RANGE</th>
<th>RISK CATEGORY</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 years</td>
<td>Low-moderate</td>
<td>Brush at least twice daily using non-fluoridated toothpaste (e.g. toddler training pastes) to reduce the risk of fluorosis (see below).</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Brush at least twice daily with a smear of fluoridated toothpaste.</td>
</tr>
<tr>
<td>2 – 6 years</td>
<td>Low-moderate</td>
<td>Brush at least twice daily with a pea-sized amount of fluoridated toothpaste; teach to spit out toothpaste.</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Brush at least twice daily with prescription strength fluoridated toothpaste.</td>
</tr>
<tr>
<td>&lt; 7 years</td>
<td>All</td>
<td>Parental assistance of tooth brushing activities.</td>
</tr>
</tbody>
</table>
MOUTH RINSES

Some of the over the counter mouth rinses contain fluoride. These should be used daily to weekly in a “swish and spit” manner. A Cochrane report demonstrates that the regular use of fluoride mouth rinse reduces tooth decay in children by an average of 26%. Children younger than seven years of age, who are unable to spit, generally should not use fluoride rinses due to the risk of ingestion and fluorosis. Some Illinois schools offer a weekly fluoride mouth rinse program that specifically has been shown to reduce decay by 35%. Pediatricians can contact their local school district to inquire if these programs exist in their area as an option for patients.

FLUOROSIS

The final word on fluoride addresses the risk for fluorosis. Fluorosis results from excessive systemic exposure of fluoride and tooth enamel deposition during tooth development. It is primarily a cosmetic concern of chalky white to dark brown discolorations as mild to moderate fluorosis actually reduces caries risk. Very mild forms of fluorosis appear as chalky, lacy markings on the tooth surface generally difficult to detect to the untrained eye. Children in whom the permanent dentition is still developing are at greatest risk for fluorosis. Therefore, the benefit of caries prevention must be weighed against the possible risk of fluorosis when prescribing or discussing fluoride supplementation with patients.

To inquire about and/or enroll in ICAAP’s Bright Smiles from Birth, oral health education and prevention program, please call Jennie Pinkwater, Project Director at 312/733-1026, ext 213.

RECOMMENDATIONS

1. Children six months to sixteen years should receive fluoride supplementation.

2. Pediatricians should assess patients’ fluoride intake and educate patients and families regarding appropriate fluoride sources.
   – Various bottled water and filtration sources should especially be discussed.

3. Parents should supervise tooth brushing for children less than seven years, encouraging them to spit out fluoridated toothpaste.
   – Amount and choice of non-fluoridated versus fluoridated toothpaste is based upon a child’s age and caries risk.

4. Pediatricians can learn to apply fluoride varnish to high-risk children through ICAAP’s Bright Smiles from Birth Program that has been shown to reduce childhood caries by 50% when combined with caregiver counseling.

5. Pediatricians should encourage and refer all patients to visit their pediatric dentist by one year of age to establish a dental home.

PATIENT AND PHYSICIAN EDUCATIONAL RESOURCES


REFERENCES
