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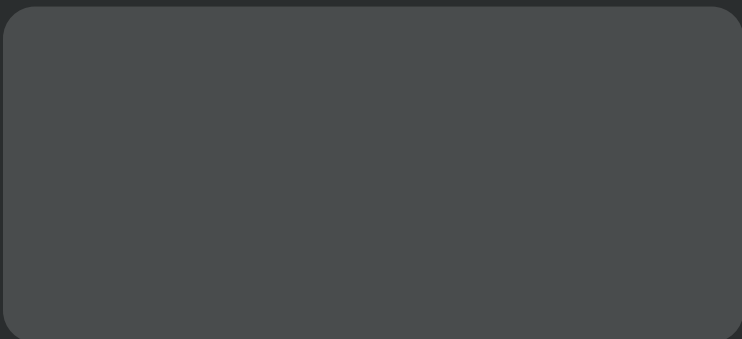
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# Following fluoride from apposition through adolescence

A peer-reviewed article written by Candace Mellino, RDH



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# Following fluoride from opposition through adolescence

## Abstract

Pediatric dental caries is a preventable oral disease affecting both hard and soft tissues. Children's positive oral health outcomes start with parental education prior to birth. After birth, without proper education, poor diet and home care could result in high levels of *Streptococcus mutans*, the bacteria commonly found in caries. These circumstances, along with residing in a nonfluoridated community, can compromise the oral and overall health of children and adolescents. Fluoride can set children up with a promising dental future. Clinicians must provide a strong foundation of patient education during and after pregnancy with multiple fluoride treatment options that will prevent disease and maintain healthy deciduous, mixed, and permanent dentition.

## Educational objectives

1. Identify pediatric patients who are at high risk for caries based on past and present circumstances and their need for fluoride to aid in caries prevention and maintenance.
2. Perform proper fluoride treatments on pediatric patients.
3. Identify the many available options for fluoride implementation.
4. Summarize systemic and supplemental fluoride methods along with their effects anatomically.

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Pediatric dental caries is a preventable oral disease. After birth, poor diet and poor home care could result in higher levels of the bacteria *Streptococcus mutans*. Residing in a nonfluoridated community and lacking access to dental care can compromise the oral and overall health of children and adolescents. According to the World Health Organization (WHO), it is estimated that 2.4 billion people globally suffer from caries of permanent teeth, and 486 million children suffer from caries of primary teeth.<sup>1</sup> Educating pregnant patients about fluoride (F) and application postnatally as early as three months could change the trajectory of this ongoing cycle. During pregnancy, nearly half of women do not seek dental care for themselves.<sup>2</sup> Nationally, a staggering 43% of pregnant women do not have regular dental checkups, even though 76% of those surveyed admitted to some sort of oral discomfort.<sup>3</sup> Diagnostic, prophylactic, and restorative dental treatment is safe and has been proven effective in improving and maintaining oral health during pregnancy, with emphasis on the healthy, non-complicated pregnant patient. Oral health is part of overall health, and it starts at the beginning.

Fluoride inhibits dental caries by affecting the metabolic activity of cariogenic bacteria while also being capable of enhancing remineralization, and this occurs continuously in the oral fluids.<sup>3-5</sup> According to the Environmental Protection Agency (EPA), the definition of drinking water “includes tap water ingested alone or with beverages and certain foods reconstituted in the home.”<sup>3</sup> Among children ages 6 months to 14 years, drinking water accounts for 40%–70% of total fluoride intake.<sup>3</sup> Toothpaste that has been swallowed inadvertently is estimated to account for about 20% of total fluoride intake in children 1 to 3 years old.<sup>3</sup> We are mostly aware of our common everyday habits of fluoride ingestion such as our drinking water, food consumption, dentifrices, tablets, mouthrinses, and drops.<sup>6</sup> Once fluoride is absorbed into the body, approximately 99% of the total amount retained is in the bones and teeth, with the remaining amount being distributed to the highly vascularized soft tissues.<sup>6</sup> Fluoride is excreted from the body primarily through

the kidneys, followed by the milk of lactating mothers, saliva, sweat, and feces.<sup>6</sup> Biologically, plasma fluid is the only means of fluoride distribution through the body.<sup>6</sup> Further studies are yet to be conducted on the relationship between greater amounts of fluoride given to pregnant women and passage to the fetus.

### Stages of tooth development

Understanding fluoride and its involvement in tooth development—or odontogenesis—is imperative. Odontogenesis refers to a certain physiological process in the embryonic period when the teeth and associated orofacial structures develop until the teeth are fully mineralized and in mature form. Odontogenesis begins during the early weeks of fetal development and is separated into six stages: initiation, bud, cap, bell, apposition, and maturation.<sup>7</sup>

**Initiation** is the first stage, and occurs in weeks six through seven of pregnancy during the embryonic period. During this developmental period, the physiological process of induction occurs, which gives rise to the oral epithelium.

At week eight of gestation, the **bud** stage begins, and proliferation occurs. During this period, growth of the dental lamina into the bud stage penetrates the growing ectomesenchyme.

Weeks nine through 10 are referred to as the **cap** stage; the main processes occurring are proliferation, differentiation, and morphogenesis. During these weeks, formation of the tooth germ occurs as the enamel organ forms into a cap shape that surrounds the inside mass of the dental papilla, with an outside mass of the dental sac; both form from the ectomesenchyme.

The fourth stage, occurring during weeks 11 through 12 and part of the primary dentition’s development, is the **bell** stage. Differentiation of the enamel organ occurs into what appears to resemble a bell with four cell types, and the dental papilla into two cell types.<sup>7</sup>

The final stages, **apposition** and **maturation**, happen at various time periods depending on tooth development. During apposition, induction and proliferation occur, and the individual dental

tissues are secreted in sequential order as a matrix. This matrix serves as a framework for later full mineralization to the tissues’ expected mature state. Enamel is the hardest, followed by dentin; the least dense is cementum.<sup>7</sup> During enamel formation, fluoride is incorporated into the crystal lattice and binds to calcium, which is contained within the protein matrix. As a result, the fluoride alters crystal formation in the enamel matrix and strengthens the properties of the enamel crystals.<sup>4</sup> The last stage is maturation, which extends from the embryonic period into the fetal period. It is during this stage that excess systemic fluoride consumption could cause enamel dysplasia by interfering with the metabolic process of the ameloblasts (enamel-forming cells), resulting in dental fluorosis.<sup>7</sup>

As stated, apposition and maturation occur at various time periods because of the multiple teeth in formation and their different eruption patterns. Primary tooth enamel and some of the permanent tooth enamel will start forming and will continue to grow in utero, while most of the permanent teeth will start to grow and fully remineralize after birth until age 25.<sup>7</sup>

### Systemic fluoride sources

Access to care and cost may be a burden to many. There are multiple sources of systemic fluoride that make it easy to incorporate it into our everyday diet, such as foods, drinks, and natural sources. Fluoride occurs naturally on earth and is released from rocks into the soil, water, and air. It is already present in all water in varying amounts depending on location, such as some groundwater and natural springs, which can have naturally high levels of fluoride.

In lesser fluoridated areas, where the amount of fluoride is usually inadequate for preventing tooth decay, obtaining prescription vitamins containing fluoride is a good option. Community water fluoridation is “the process of adjusting the amount of fluoride in drinking water to a level recommended for preventing tooth decay.”<sup>8</sup> In 1945, after extensive scientific research, the city of Grand Rapids, Michigan, was the first to add fluoride to its city water system. With consistent water



fluoridation, there has been a decline in dental decay in the past 77 years, with a national goal for 77% of Americans to have water with enough fluoride to prevent dental decay by 2030.<sup>8</sup> Community water fluoridation has been identified as the most cost-effective method to deliver fluoride and reduce dental decay by 25% in children and adults. The optimal level of fluoride in water is 0.7 parts per million (ppm), or 0.7 milligrams of fluoride per liter of water (mg/L).<sup>3</sup> For infants through age 8, 0.10 mg/kg per day is an appropriate concentration, and the upper limit for older children and adults is set at 10 mg per day regardless of weight.<sup>4</sup> These standards have been set for caries prevention and reducing the risk of fluorosis.

During gestation, fluoride can be transported from maternal serum to the fetus and prenatal deciduous enamel. The mechanism of transmission has been reported to be through the placenta, which allows passive diffusion of fluoride from mother to fetus when fluoride intake is low. The placenta has the ability to act as a selective barrier when fluoride intake exceeds a particular level.<sup>4</sup>

Fluoride is found in the air and in the soil in which crops are grown.<sup>8</sup> There are areas with higher levels of fluoride in the water used for crop irrigation (such as rice farms), which should be monitored and taken into consideration when consuming other sources of fluoride.<sup>1</sup> Tea plants could potentially absorb fluoride from the soil in great amounts, especially “brick” tea, which is popular in certain parts of Asia. In many parts of the world, food is the primary source of fluoride intake.<sup>1</sup> Most foods contain trace amounts of fluoride, with higher amounts found in canned fish with bones, such as salmon and sardines. Meat, fruit, and vegetables tend to have the least trace amounts. It is common practice in the Caribbean and Latin America to add fluoride to table salt or cooking salt because drinking water fluoridation is not feasible. Fluoride is also added to milk for caries prevention in other parts of the world.<sup>1</sup> Fertilizers, wind, and volcanic emissions are all ways that fluoride is transmitted into the environment organically.<sup>1</sup>

Postnatally, breast milk and infant formula are a means of fluoride transmission

and may be more impactful in strengthening the primary dentition.<sup>6</sup> Breast milk and formula are the major dietary needs in the beginning stages of infants’ lives and play a valuable role as a fluoride supplement. Regarding breast milk, fluoride is transferred and distributed in limited amounts utilizing the biological fluid, plasma.<sup>6</sup> According to the WHO, breast milk fluoride levels range from less than 0.002 ppm to about 0.1 ppm, with most values being between 0.005 and 0.010 ppm. These amounts are less than infant formula, which ranges from 1.95 to 7.45 ppm, and cow’s milk, which is 0.12 ppm.<sup>6</sup> As the infant continues to grow into adolescence, with daily consumption of fluoridated water, beverages, and food prepared or processed with fluoridated water, remineralization is enhanced and maintained in low concentrations through the saliva and biofilm.<sup>3</sup>

### Topical fluoride sources

Less than 0.6 ppm fluoride is considered fluoride-deficient water,<sup>5</sup> and in this case, supplements should be recommended, such as over-the-counter and prescription dentifrices, mouthrinses, chewing gum, tablets, and professionally applied treatments such as gels, foam, or varnish. Every infant or child is categorized on their caries risk: low, medium, or high. Risk indicators include presence of carious lesions, low salivary flow, visible plaque on teeth, high sugar consumption, presence of an appliance in the mouth, health challenges, sociodemographic factors, access to care, and cariogenic microflora. Multiple variables should be evaluated when determining follow-through of a particular treatment. Dietary interventions may also need to be implemented for food and drinks high in sugar.<sup>10</sup>

The most-used professionally applied fluoride agent is 5% sodium fluoride varnish (NaFV) at 2.26% fluoride (22,600 ppm F). It is normally an insurance-covered service until the age of 13. Proper education should be given to the patient and caregiver on the importance of fluoride when insurance coverage is not feasible.

Additionally, 1.23% acidulated phosphate fluoride (APF) can be used in the

prevention of decay.<sup>5</sup> At 12,300 ppm F and a low pH of 3.5,<sup>5</sup> APF can enhance fluoride uptake but should be used with caution because of its ability to etch restorative materials such as porcelain and composite.

Gel is another means of supplemental fluoride, and according to a meta-analysis, once eruption has commenced, applying fluoride gel as young as 6 months to 1 year has been proven efficacious in reducing caries in developing permanent teeth.<sup>4</sup>

Another in-office option for supplemental fluoride is in the form of foam; however, there is limited evidence that topical fluoride foams are effective in children.

Mouthrinses have a tremendous benefit for pediatric patients because of their fluidity, but they should be supervised and only implemented once the child is able to rinse and expectorate appropriately. Deep pits and grooves of newly erupted teeth are at higher risk for dental decay because of the difficulty they pose with brushing and flossing. A 0.05% (0.02% weight per volume [w/v] fluoride ion) mouthrinse can be beneficial for the deeper pits and grooves where access is troublesome.

Toothpaste with fluoride was first introduced in 1955, and since then, consistent use of fluoridated toothpaste has reduced dental caries prevalence in primary and permanent dentitions.<sup>3</sup> For children less than 3 years old, a smear amount of toothpaste should be used, and a pea-size amount for children ages 3 through 6.<sup>9,10</sup> Following these guidelines—assuming other means of fluoride absorption are kept at a normal limit—will reduce the chance of fluorosis in the developing teeth.

Over-the-counter toothpastes come in a variety of fluoride concentrations, most commonly sodium monofluorophosphate at 0.76% fluoride (0.15 w/v fluoride ion) and sodium fluoride (NaF) at 0.243% (0.15% w/v fluoride ion). Other over-the-counter dentifrices may also contain stannous fluoride (SnF<sub>2</sub>), which has antimicrobial properties with 0.454% fluoride (0.15% w/v fluoride ion) and should be used by children 6 years and older.<sup>5</sup> Stannous fluoride has been proven to kill bacteria found in biofilm that causes gum disease and tooth decay and acts as a desensitizing agent by forming a coating over open dentinal

tubules. For those children 6 years and older who are at high risk for dental decay, prescription-strength options for home use are available, such as 0.5% gels and pastes, as well as 0.09% fluoride mouth-rinse. High levels of fluoride from prescription and in-office alternatives produce a temporary layer of calcium fluoride-like material on the enamel surface, strengthening the teeth. Fluoride is then released when the pH drops in response to the acidic oral environment and becomes available to remineralize, strengthening the enamel that affects the bacterial metabolism.<sup>5</sup>

### Caries management

Proven safe and beneficial, 38% silver diamine fluoride (SDF) is part of a comprehensive caries management program in primary teeth for the high-risk patient.<sup>11</sup> Some studies show caries arrest greater than 80%.<sup>5</sup> The mechanism of action is through the antibacterial effects of silver and remineralization of enamel and dentin.<sup>5</sup> SDF is 5% fluoride (44,800 ppm) and is considered a class II medical device that can also be used in the treatment of dentinal hypersensitivity. It has approximately two to three times more fluoride retained than delivered by sodium fluoride, stannous fluoride, or acidulated phosphate fluoride commonly found in foams, gels, and varnishes, and it is safe for both children and adults. Less than a drop is needed for several carious lesions, and the only negative side effect is black stain where the caries has been arrested.<sup>5,11,12</sup>

### Maternal fluoride consumption during pregnancy

Some studies have been conducted on the potential impact of fluoride consumption prenatally. A study by Takahashi et al. reviewed the effects of women taking fluoride supplements (tablets, drops, lozenges, or chewing gum) compared with no fluoride supplementation during pregnancy to prevent caries in the primary teeth of their children.<sup>4</sup> The selection criteria were done by a randomized control trial in southern Maine. A daily dose of 1 mg sodium fluoride tablets or placebo tablets was given to a total of 1,400 pregnant women from their fourth month of

pregnancy until they gave birth.

Primary teeth decay measured in children ages 3 and 5 was very low in both the fluoride supplement group and the placebo group. At 5 years old, 92% of children remained caries-free in the fluoride supplement group and 91% remained caries-free in the placebo group, ultimately indicating that fluoride supplements taken by women during pregnancy were not effective in preventing dental decay in their offspring. Further studies are needed to assess the efficacy of increased maternal fluoride uptake for caries reduction in the offspring; however, current data suggests that it does not provide a measurable effect.

### Fluoride concerns

Fluoride recommendations are frequently met with resistance because of potential side effects. Fluorosis is excessive fluoride ingestion while the teeth are developing and is detected visually by changes in the tooth enamel. These changes range from slightly visible lacy white markings in most mild cases to pitting of the teeth in rare, severe cases. Excessive fluoride uptake from the period between birth and 8 years old will put permanent teeth at risk, since preeruptive maturation of tooth enamel is in the stage of completion. Risk of severity depends on the amount, timing, frequency, and duration of exposure.<sup>3</sup> Since the 1980s, fluorosis has increased, mostly in mild forms. As previously stated, the fluoride concentration of 0.7 mg/L in water has been proven to maintain caries prevention while reducing the risk of dental fluorosis.<sup>3</sup> It is the clinician's responsibility to have an open discussion about the possible elevated fluoride levels the patient may incur in addition to drinking water.

Another concern is negative cognitive outcomes in children. One study measured mothers' urinary fluoride levels and compared it to the child's IQ. This study suggested a negative association when levels were greater than those recommended in the US for water fluoridation.<sup>13</sup> Another study in New Zealand did not support the association between the two.<sup>14</sup> Currently, there is not enough evidence to conclude whether fluoride in drinking

water at concentrations used for community water fluoridation might impair the IQ of children.<sup>14</sup>

### Patient education

Often patients do not truly understand the real impact of fluoride. Using literature, photos, videos, models, reference guides, and taking intraoral photos can teach patients how fluoride and proactive oral hygiene can be impactful. Unfortunately, those who are pain-free often believe there is not a problem. Taking a photo and showing the patient firsthand the breakdown that is occurring in their mouth or the mouths of their children can turn an opinion around quickly. When a patient or caregiver can see what the lesion looks like, they become much more proactive in prevention. Radiographs are useful as well, but tend not to be as impactful because often what is seen on a radiograph is too clinical for the patient to understand. Finally, providing the patient or caregiver with a consent form stating that they are aware of their oral-health situation, with all the lesions and areas to monitor noted, will put the responsibility on the patient and hopefully prompt them to follow through on their treatment and prevention.

Patient education is by far the most important piece to this puzzle, and having a clinician patients trust is crucial. Many patients suffer from odontophobia, which is defined as "an overwhelming and irrational fear of dentistry associated with devastating feelings of hypertension, terror, trepidation, and unease."<sup>15</sup> Positive reinforcement and constant reassurance will help the patient understand that they can take on certain dental fears. Once trust is given, the clinician can openly discuss all the preventive measures that can be taken. Understanding dental anxiety is vital, and being prepared for it sets up the patient, caregiver, and clinician for a successful appointment and follow-through.

### Conclusion

In summary, we can continue to help dental disease decline by understanding that pediatric dental caries is a preventable oral disease and implementation of fluoride is crucial. Early intervention and education during tooth

development will set children up for a more promising dental future and an overall healthier life. Without continuous water fluoridation, this would not be possible in areas where access to care is limited or nonexistent.

Water fluoridation is the most cost-effective way to reach the greatest population. Evaluating diet, home care, and access to fluoride can help clinicians create a treatment plan utilizing professional and over-the-counter resources to aid in the reduction of pediatric dental caries. Additionally, clinicians should reassure

patients that seeking dental care during pregnancy is imperative and safe. Topical fluoride is an effective means of caries prevention and is safe during pregnancy and in children beginning at 3 months of age. This will lay the groundwork for all future pediatric appointments as well as set a strong positive example. Collaborate with the patient's prenatal care team so that the circle of dental care and prenatal health care can become one. Oral health is a vital part of overall health, and establishing patient/clinician trust is where it all begins.

## References

1. Inadequate or excess fluoride: a major public health concern. World Health Organization. May 1, 2019. Accessed December 17, 2021. <https://www.who.int/publications/i/item/WHO-CED-PHE-EPE-19.4.5>
2. Chambers DW. The dilemma dilemma. *J California Dent Assoc.* 2016;44(1):7-14. [https://www.cda.org/portals/0/journal/journal\\_012016.pdf](https://www.cda.org/portals/0/journal/journal_012016.pdf)
3. Gooch BF. U.S. Public Health Service recommendation for fluoride concentration in drinking water for the prevention of dental caries. *Public Health Rep.* 2015;130(4):318-331.
4. Takahashi R, Ota E, Hoshi K, et al. Fluoride supplementation (with tablets, drops, lozenges or chewing gum) in pregnant women for preventing dental caries in the primary teeth of children.

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## QUESTIONS

1. How many children suffer from caries of primary teeth?
  - A. 4.6 billion
  - B. 486 million
  - C. 2.4 billion
  - D. 99 million
2. In children age 6–14 years, drinking water accounts for what percentage of total fluoride intake?
  - A. 40%–60%
  - B. 20%–99%
  - C. 40%–70%
  - D. 20%–40%
3. What percentage of total fluoride is inadvertently swallowed from toothpaste in children age 1–3 years?
  - A. 20%
  - B. 30%
  - C. 28%
  - D. 40%
4. What percentage of fluoride is retained in the bone and teeth?
  - A. 90%
  - B. 60%
  - C. 40%
  - D. 99%
5. By which route is fluoride excreted from the body?
  - A. Saliva
  - B. Milk of lactating mothers
  - C. Sweat
  - D. All of the above
6. What is the primary source of fluoride excretion in the body?
  - A. Sweat
  - B. Kidneys
  - C. Saliva
  - D. All of the above
7. Which term means "the process of tooth development"?
  - A. Odontophobia
  - B. Odontogenesis
  - C. Apposition
  - D. Maturation
8. Ameloblasts form which kind of dental cell?
  - A. Enamel
  - B. Dentin
  - C. Cementum
  - D. None of the above
9. Which stage in tooth development occurs at different time periods?
  - A. Initiation stage
  - B. Maturation stage
  - C. Bud stage
  - D. All of the above
10. Odontogenesis is composed of how many stages?
  - A. 1
  - B. 2
  - C. 4
  - D. 6
11. The cap stage occurs in which weeks of gestation?
  - A. 6–7
  - B. 8–9
  - C. 9–10
  - D. Various weeks
12. Fluoride is released naturally from rock into:
  - A. Soil
  - B. Water
  - C. Air
  - D. All of the above
13. What year was fluoride first added to a city water system?
  - A. 1943
  - B. 1955
  - C. 1945
  - D. 1991
14. What is considered the optimal level of fluoride for community water fluoridation?
  - A. 0.12 mg/L
  - B. 0.7 mg/L
  - C. 0.5 mg/L
  - D. 1.0 mg/L
15. What is the appropriate daily concentration of fluoride for older children and adults?
  - A. 0.10 mg/kg
  - B. 0.5 mg/kg
  - C. 0.12 mg/kg
  - D. 0.6 mg/kg
16. Where is it common practice to add fluoride to table salt?
  - A. United States
  - B. The Caribbean
  - C. Europe
  - D. None of the above

- Cochrane Database Syst Rev.* 2017;10(1):CD011850. doi:10.1002/14651858.
- American Academy of Pediatric Dentistry. Fluoride therapy. *The Reference Manual of Pediatric Dentistry.* 2021:302-305. Accessed December 1, 2021.
  - Şener Y, Tosun G, Kahvecioğlu F, et al. Fluoride levels of human plasma and breast milk. *Eur J Dent.* 2007;1(1):21-24.
  - Fehrenbach MJ, Popowics T. *Illustrated Dental Embryology, Histology, and Anatomy.* Elsevier Saunders; 2016.
  - Water fluoridation basics. Centers for Disease Control and Prevention. 2018. Accessed December 28, 2021. <https://www.cdc.gov/fluoridation/basics/index.htm>
  - More J. *Infant, Child and Adolescent Nutrition: A Practical Handbook.* CRC Press; 2013.
  - Caries-risk assessment and management for infants, children, and adolescents. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry. 2021:252-257. Accessed December 1, 2021.
  - Policy on the use of silver diamine fluoride for pediatric dental patients. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry. 2021:68-71.
  - Reggiardo P, Sabino GJ. Silver diamine fluoride—the new old: part 1. *J California Dent Assoc.* 2018;46(1):15-18.
  - Bashash M, Thomas D, Hu H, et al. Prenatal fluoride exposure and cognitive outcomes in children at 4 and 6–12 years of age in Mexico. *Environ Health Perspect.* 2017;125(9):097017.
  - Broadbent JM, Thomson WM, Ramrakha S, et al. Community water fluoridation and intelligence: prospective study in New Zealand. *Am J Public Health.* 2015;105(1):72-76.
  - Appukkuttan DP. Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clin Cosmet Investig Dent.* 2016;8:35-50.



**CANDACE MELLINO, RDH**, is a registered dental hygienist with extensive experience working with all dental specialties focusing on pediatrics, periodontics, and highly anxious patients. She has acted as implant coordinator for a multispecialty practice and has

organized public-health projects making access to care possible for those most in need. Mellino actively educates families on the importance of oral health as a part of overall health and believes that proper care cannot exist if patient trust is not top priority.

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## QUESTIONS

- What is the most common means of fluoride transmission to the infant?
  - Breast milk
  - Brushing gums with a smear of fluoride toothpaste
  - Infant formula
  - A and C
- During the formation of enamel, into what is fluoride directly incorporated?
  - Protein matrix
  - Crystal lattice
  - A and B
  - None of the above
- At what age is the permanent dentition fully mineralized?
  - 28
  - 18
  - 21
  - 25
- What is the most cost-effective way to deliver fluoride and reduce dental decay?
  - Toothpaste
  - Foods grown in fluoride-rich soil
  - Community water fluoridation
  - Infant formula
- By which mode of transmission is fluoride released into the environment?
  - Fertilizers
  - Wind
  - Volcanic emissions
  - All of the above
- The average fluoride level in cow’s milk is:
  - 1.95 ppm
  - 0.005 ppm
  - 0.12 ppm
  - 7.45 ppm
- Remineralization of the teeth is enhanced and maintained in low concentrations through which mode of transmission?
  - Saliva
  - Biofilm
  - Toothpaste
  - A and B
- Which food has the least trace amounts of fluoride?
  - Fruit
  - Rice
  - Salmon
  - Sardines
- Water is considered fluoride deficient when it is less than how many ppm F?
  - >0.12
  - >0.005
  - >0.6
  - >0.7
- Which fluoride can etch restorative materials such as porcelain and composite?
  - SnF<sub>2</sub>
  - NaF
  - NaFV
  - APF
- What is the most commonly used professionally applied fluoride agent?
  - SDF
  - NaFV
  - NaF
  - APF
- What year was toothpaste with fluoride first introduced?
  - 1945
  - 1996
  - 1955
  - 1980
- Which fluoride requires less than a drop to arrest several carious lesions?
  - SDF
  - APF
  - SnF<sub>2</sub>
  - NaFV
- Risk of fluorosis severity depends on which factor?
  - Timing
  - Frequency
  - Amount
  - All of the above



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ANSWER SHEET

# Following fluoride from apposition through adolescence

NAME: \_\_\_\_\_ TITLE: \_\_\_\_\_ SPECIALTY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_ EMAIL: \_\_\_\_\_ AGD MEMBER ID (IF APPLIES): \_\_\_\_\_

CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP: \_\_\_\_\_ COUNTRY: \_\_\_\_\_

TELEPHONE (PRIMARY): \_\_\_\_\_ TELEPHONE (OFFICE): \_\_\_\_\_

**REQUIREMENTS FOR OBTAINING CE CREDITS BY MAIL/FAX:** 1) Read entire course. 2) Complete info above. 3) Complete test by marking one answer per question. 4) Complete course evaluation. 5) Complete credit card info or write check payable to Endeavor Business Media. 6) Mail/fax this page to DACE. If you have any questions, please contact [dace@endeavor2b.com](mailto:dace@endeavor2b.com) or call (800) 633-1681. A score of 70% or higher is required for CE credit.

**COURSE CAN ALSO BE COMPLETED ONLINE AT A LOWER COST.** Scan the QR code or go to [dentalacademyofce.com](http://dentalacademyofce.com) to take advantage of the lower rate.



## Educational Objectives

- Identify pediatric patients who are at high risk for caries based on past and present circumstances and their need for fluoride to aid in caries prevention and maintenance
- Perform proper fluoride treatments on pediatric patients
- Identify the many available options for fluoride implementation
- Summarize systemic and supplemental fluoride methods along with their effects anatomically

## Course Evaluation

- Were the individual course objectives met?
 

Objective #1: Yes No	Objective #3: Yes No
Objective #2: Yes No	Objective #4: Yes No

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

- |   |       |    |   |   |   |   |
|---|-------|----|---|---|---|---|
| 2. To what extent were the course objectives accomplished overall?                            | 5     | 4  | 3 | 2 | 1 | 0 |
| 3. Please rate your personal mastery of the course objectives.                                | 5     | 4  | 3 | 2 | 1 | 0 |
| 4. How would you rate the objectives and educational methods?                                 | 5     | 4  | 3 | 2 | 1 | 0 |
| 5. How do you rate the author's grasp of the topic?   | 5     | 4  | 3 | 2 | 1 | 0 |
| 6. Please rate the author's effectiveness.  | 5     | 4  | 3 | 2 | 1 | 0 |
| 7. Was the overall administration of the course effective?                                    | 5     | 4  | 3 | 2 | 1 | 0 |
| 8. Please rate the usefulness and clinical applicability of this course.                      | 5     | 4  | 3 | 2 | 1 | 0 |
| 9. Please rate the usefulness of the references.  | 5     | 4  | 3 | 2 | 1 | 0 |
| 10. Do you feel that the references were adequate?  | Yes   | No |   |   |   |   |
| 11. Would you take a similar course on a different topic?                                     | Yes   | No |   |   |   |   |
| 12. If any of the continuing education questions were unclear or ambiguous, please list them. | _____ |    |   |   |   |   |

- Was there any subject matter you found confusing? Please describe.  
\_\_\_\_\_
- How long did it take you to complete this course?  
\_\_\_\_\_
- What additional dental continuing education topics would you like to see?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Mail/fax completed answer sheet to:

**Endeavor Business Media**

Attn: Dental Division  
7666 E. 61st St. Suite 230, Tulsa, OK 74133  
Fax: (918) 831-9804

Payment of \$69 is enclosed (this course can be completed online for \$39. Scan the QR code or go to [dentalacademyofce.com](http://dentalacademyofce.com) to take advantage of the lower rate).

**Make check payable to Endeavor Business Media**

If paying by credit card, please complete the following:

MC     Visa     AmEx     Discover

Acct. number: \_\_\_\_\_

Exp. date: \_\_\_\_\_ CVC #: \_\_\_\_\_

Billing address: \_\_\_\_\_

Charges on your statement will show up as Endeavor.

- |                     |                     |
|---------------------|---------------------|
| 1. (A) (B) (C) (D)  | 16. (A) (B) (C) (D) |
| 2. (A) (B) (C) (D)  | 17. (A) (B) (C) (D) |
| 3. (A) (B) (C) (D)  | 18. (A) (B) (C) (D) |
| 4. (A) (B) (C) (D)  | 19. (A) (B) (C) (D) |
| 5. (A) (B) (C) (D)  | 20. (A) (B) (C) (D) |
| 6. (A) (B) (C) (D)  | 21. (A) (B) (C) (D) |
| 7. (A) (B) (C) (D)  | 22. (A) (B) (C) (D) |
| 8. (A) (B) (C) (D)  | 23. (A) (B) (C) (D) |
| 9. (A) (B) (C) (D)  | 24. (A) (B) (C) (D) |
| 10. (A) (B) (C) (D) | 25. (A) (B) (C) (D) |
| 11. (A) (B) (C) (D) | 26. (A) (B) (C) (D) |
| 12. (A) (B) (C) (D) | 27. (A) (B) (C) (D) |
| 13. (A) (B) (C) (D) | 28. (A) (B) (C) (D) |
| 14. (A) (B) (C) (D) | 29. (A) (B) (C) (D) |
| 15. (A) (B) (C) (D) | 30. (A) (B) (C) (D) |

**EXAM INSTRUCTIONS**

All questions have only one answer. If mailed or faxed, grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a Verification of Participation form. The form will be mailed within two weeks after receipt of an examination.

**COURSE EVALUATION AND FEEDBACK**

We encourage participant feedback. Complete the evaluation above and e-mail additional feedback to [Laura.Winfield@endeavor2b.com](mailto:Laura.Winfield@endeavor2b.com).

**COURSE CREDITS AND COST**

All participants scoring 70% or higher on the examination will receive a verification form for three (3) continuing education (CE) credits. Participants are urged to contact their state dental boards for CE requirements. The cost for courses ranges from \$20 to \$110.

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Dental Board of California: Provider RP5933. Course registration number CA code: 03-5933-22112. Expires 7/31/2024. \*This course meets the Dental Board of California's requirements for three (3) units of continuing education.\*

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Endeavor Business Media maintains records of your successful completion of any exam for a minimum of six years. Please contact our offices for a copy of your CE credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

**CANCELLATION AND REFUND POLICY**

Participants who are not 100% satisfied can request a refund by contacting Endeavor Business Media in writing.

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