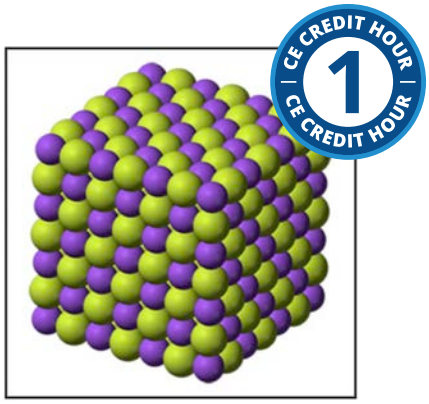
Caries Process and Prevention Strategies: Intervention



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Intended Audience: Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assistant Students
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Online Course: *www.dentalcare.com/en-us/professional-education/ce-courses/ce376*

Conflict of Interest Disclosure Statement

- Mr. Faller is a retired employee of P&G.

Introduction

This is part 9 of a 10-part series entitled *Caries Process and Prevention Strategies*. This course introduces the dental professional to the important role of fluoride in the prevention and control of dental caries. Systemic and topical forms of fluoride delivery are discussed as options for the majority of patients, and professional forms of fluoride delivery are discussed as sometimes-necessary measures for high-risk patients with severe caries.

Course Contents

Overview

This course introduces the dental professional to the important role of fluoride in the prevention and control of dental caries. Systemic and topical forms of fluoride delivery are discussed as options for the majority of patients, and professional forms of fluoride delivery are discussed as sometimes necessary measures for high-risk patients with severe caries.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Be familiar with the history of fluoride in caries control.
- Discuss how fluoride is processed by the body.
- Describe how fluoride concentration varies in different parts of the tooth.
- Identify the multiple ways in which fluoride provides protection from caries.
- Explain the dental health consequences of too much fluoride exposure.
- Discuss the primary methods of systemic and topical fluoride delivery.
- Understand when professional forms of fluoride delivery may be necessary.

Glossary

biofilm – An aggregation of microorganisms in which cells adhere to each other forming small communities that are held together by an extracellular polymeric matrix. Different communities are co-dependent on each other, and the whole biofilm forms a defensive mechanism requiring much higher concentrations of antimicrobials to control its growth. Dental plaque is a classic biofilm.

demineralization – The chemical process by which minerals (mainly Calcium) are removed from the dental hard tissues – enamel, dentin, and cementum. The chemical process occurs through dissolution by acids or by chelation, and the rate of demineralization will vary due to the degree of supersaturation of the immediate environment of the tooth and the presence of fluoride. In optimal circumstances, the minerals may be replaced through the process of remineralization.

dental fluorosis – An abnormal condition caused by the excessive intake of fluorine, such as from fluoridated drinking water, during the period in which tooth buds are developing (amelogenesis), and is characterized in the developed tooth chiefly by mottling of the enamel. This condition can range from white flecks in the enamel (mild fluorosis) up to brown, stained and pitted enamel (severe).

enzyme – Protein that catalyzes, or facilitates, biochemical reactions.

fluoride – The anion of the halogen fluorine (F-). Compounds containing the fluoride anion are collectively called fluorides. Fluoride compounds very commonly occur, from simple fluoride toothpastes to PTFE (Teflon).

fluoride dentifrice – A toothpaste that has been formulated to deliver clinically proven amounts of fluoride into the oral cavity, and to bind to tooth surfaces creating fluorapatite and Calcium fluoride, both of which protect the tooth from the acids produced by cariogenic bacteria.

fluoride supplements – The diet of children can be supplemented with sodium fluoride, similar to vitamin supplementation, in areas where water fluoridation, or availability of fluoride by other means, such as milk or salt, may not be available.

fluorapatite – A crystal structure in tooth mineral [Ca_{10} (PO_4)$_6$ F_2] resulting from the replacement of hydroxyl ions (OH-) in the hydroxyapatite structure with fluoride ions (F-). Fluorapatite (also commonly referred to as fluoroapatite, fluorhydroxyapatite or fluorohydroxyapatite) is stronger and more acid resistant than hydroxyapatite.

hydroxyapatite – Crystals of calcium phosphate - [$Ca_{10}(PO_4)_6$ OH_2] - that form the mineral structure of teeth and bone. Enamel comprises approximately 98% hydroxyapatite. Much of the hydroxyapatite in enamel, however, is a calcium-deficient carbonated hydroxyapatite, the crystals of which are readily dissolved by acids. The addition of fluoride creates fluorapatite, which is less soluble and more acid-resistant.

hypomineralization – Relating to or characterized by a deficiency of minerals.

milk fluoridation – Milk provides an ideal vehicle to deliver the correct amount of fluoride to children. However, well-controlled studies have not yet been conducted to confirm the anticaries benefits of this approach, and this is necessary before this method can be recommended for implementation in the United States.

mottled enamel – A chronic endemic form of hypoplasia (incomplete development) of the dental enamel caused by excessive intake of fluoride by a child during key stages of tooth formation. It is characterized by defective calcification that results in a chalky appearance to the enamel, which gradually undergoes brown discoloration.

remineralization – The chemical process by which minerals (mainly Calcium) are replaced into the substance of the dental hard tissues - enamel, dentin and cementum. The process requires an ideal environment that includes supersaturation with calcium and phosphate ions, the presence of fluoride, and adequate buffering.

water fluoridation – The addition or removal of fluoride from domestic water supplies to achieve the optimal concentration of fluoride. The optimal concentration varies due to ambient temperature of the climate and thus water intake. Hexafluorosilicic acid (H_2SiF_6) and its salt sodium hexafluorosilicate (Na_2SiF_6) are the more commonly used additives, especially in the United States.

Video: Intervention

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Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: *www.dentalcare.com/en-us/professional-education/ce-courses/ce376/test*

1. Which of the following is a key finding that led to the understanding of the benefit of fluoride in public dental health?

A. Children who lived in towns with abnormally high levels of fluoride in the water supply had perfectly healthy teeth.
B. A new pipeline with an alternative water source pumped into the town of Oakley, Idaho, led to the disappearance of "brown stain" on teeth.
C. Analysis of the water supply of Bauxite, Arkansas, uncovered an unusually high level of fluoride and this was confirmed in other towns with fluorosis.
D. B and C

2. The majority of fluoride ingested in water or food is absorbed in which body organ(s)?

A. Lymphatic system
B. Kidneys
C. Stomach and small intestine
D. Liver

3. Fluoride incorporates into the enamel structure as _____.

A. hydroxyapatite
B. apatite crystal
C. fluorapatite
D. enameloxyapatite

4. Which of the following is false about the concentration of fluoride in teeth?

A. Fluoride concentration is highest on surface enamel.
B. Fluoride concentration is high in dentin.
C. Fluoride accumulates over a lifetime at the dentin-pulp interface.
D. Fluoride only adsorbs onto the surface of the teeth; it does not penetrate into the teeth themselves.

5. What is the main mechanism by which fluoride protects the tooth from caries?

A. Fluoride helps to reduce demineralization and enhance remineralization.
B. Fluoride increases saliva production.
C. Fluoride helps keep tooth enamel white.
D. Fluoride is able to kill *P. gingivalis* bacteria, a major contributor to caries.

6. Which of the following is true regarding the mode of action for the antimicrobial effects of fluoride?

A. Inhibits growth and metabolism of streptococci.
B. At higher concentrations, it can inhibit acid production by plaque bacteria.
C. Fluoride has no significant antimicrobial effects.
D. A and B

7. Chalky white lines or stains are believed to be caused by which of the following?

A. An abnormally high level of *Streptococcus mutans* in plaque.
B. An abnormally high concentration of fluoride that leads to hypomineralization of tooth enamel.
C. Excessive consumption of vitamin C.
D. Excessive consumption of calcium.

8. What is the average percentage in caries reduction among children where community drinking water contains 1 ppm fluoride?

A. 10%
B. 30%
C. 50%
D. 90%

9. Which of the following research findings validates that consistent fluoride protection is needed to maintain a reduction in caries rate?

A. Children who move from non-fluoridated areas to other non-fluoridated areas experienced a caries decrease.
B. Children who move from fluoridated areas to non-fluoridated areas experienced a caries increase.
C. Children who move from non-fluoridated areas to fluoridated areas experienced a caries increase.
D. Children who move from fluoridated areas to non-fluoridated areas experienced a caries decrease.

10. Fluoride supplements are recommended for which population of people?

A. Everyone.
B. Adults only, regardless of caries risk.
C. Children at high risk of caries residing in non-fluoridated areas.
D. Children only, regardless of caries risk.

11. How much fluoride does most over-the-counter dentifrice contain in the United States?

A. 100 ppm to 200 ppm
B. 850 ppm to 1150 ppm
C. 3000 ppm
D. 1 ppm

12. Which forms of fluoride are the most commonly used in dentifrice?

A. Stannous fluoride, Potassium fluoride and Amine fluoride.
B. Sodium fluoride, Stannous fluoride and Sodium monofluorophosphate.
C. Sodium bi-fluorophosphate, Amine fluoride and Calcium fluoride.
D. Sodium fluoride, Fluorapatite and Calcium fluoride.

13. Which of the following mechanisms explains why using a cup to rinse the mouth with water after brushing with fluoridated dentifrice is linked to more caries?

A. Water makes fluoride more acidic.
B. Water diminishes fluoride's ability to work as an antimicrobial.
C. Water reduces saliva production.
D. The large amount of water from using a cup as a rinsing aide flushes away the beneficial fluoride.

14. Which of the following types of fluoride should be recommended with caution due to the potential for it to cause pitting and etching of porcelain or composite restorations?

A. Stannous fluoride
B. Sodium monofluorophosphate
C. Acidulate phosphate fluoride
D. Sodium fluoride

15. Which of the following is true about professionally applied fluoride varnish?

A. Used correctly, it is linked to a 38% reduction in caries.
B. It forms a hardened deposit of calcium fluoride on the tooth acting as a reservoir for the release of fluoride over time.
C. It usually contains about 1,100 ppm of fluoride.
D. Professionally applied dental varnishes do not contain fluoride.

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Additional Resources

- No Additional Resources Available.

About the Author

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Robert Faller has in excess of 40 years in the Oral Care Research field. He retired from P&G after more than 31 years in Oral Care, where he focused on caries and enamel related research as P&G's chief cariologist. He is editor of *Volume 17 – Monographs in Oral Science: Assessment of Oral Health – Diagnostic Techniques and Validation Criteria*. He has written 3 book chapters, published 34 papers in peer-reviewed journals and has over 100 published abstracts on fluoride, caries, dental erosion, and various oral care technologies, along with 5 patents related to Oral Care and 6 Continuing Education courses. He currently resides in the UK and is a consultant to the Oral Care industry.

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