LESSON PLAN & TEST QUESTIONS

Course: Dental Materials-2

Topic: Fluoride Therapy

Audience: Adult Learners (Fourth Level Dental Hygiene Students)

Instructional Objectives: Upon completion of the lecture, the student should be able to:

1. Define the element of fluoride.
2. Describe the process of fluoride metabolism in the body.
3. List multiple sources of fluoride.
4. Evaluate the relationship between fluoride and tooth decay prevention.
5. Demonstrate a commitment to remain aware of potential toxic effects of fluoride.

Materials: PowerPoint
Handout

References:

American Dental Association. (2018). *Fluoridation facts.* Retrieved from http://www.ada.org/~/media/ADA/Files/Fluoridation_Facts.pdf?la=en

American Dental Association. (2019). *Fluoride: Topical and systemic supplements.* Retrieved from https://www.ada.org/en/member-center/oral-health-topics/fluoride-topical-and-systemic-supplements

Aoun, A., Darwiche, F., Al Hayek, S., & Doumit, J. (2018). The fluoride debate: The pros and cons of fluoridation. *Preventive Nutrition and Food Science*, *23*(3), 171–180. https://doi.org/10.3746/pnf.2018.23.3.171

Center for Disease Control and Prevention. (2019). *Other fluoride products.* Retrieved from https://www.cdc.gov/fluoridation/basics/fluoride-products.html

Office of Dietary Supplements. (2019). *Fluoride: Fact sheet for health professional.* U.S. Department of Health and Human Services, National Institute of Health. https://ods.od.nih.gov/factsheets/Fluoride-HealthProfessional/#h6

Wilkins, E., & Wyche, C. (2013). *Clinical practice of the dental hygienist (11th ed.).* Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Personnel: None needed

Time: 50 minutes

TIME	LESSON CONTENT	NOTES
2 minutes	**I. INSTRUCTIONAL SET** A. Introduction For the past several decades, fluoride has been added to community water supplies and oral care products to strengthen tooth enamel and prevent dental caries. Fluoride is necessary for optimum oral health at all ages; both children and adults benefit from it. B. Established Mood By attending today's lecture, you are taking initiative to learn more about the element of fluoride while learning about its metabolic process and main sources. Today we will learn about the role of fluoride in preventing tooth decay. We will also learn about the potential toxic effects of fluoride. C. Gain Attention/Motivate If a patient or family member asked you about fluoride therapy, can you explain what fluoride is and how it can prevent caries? If so, would you know how to educate the patient on its potential toxic effects and provide them with the appropriate advice? D. Established Rational By understanding what fluoride is and understanding its role in preventing tooth decay, healthcare providers can answer basic questions from patients concerning the fluoride to make well-informed decisions and provide them with the appropriate advice about fluoride.	**Slide #1** Fluoride Therapy Title **Note:** Fluoride is a very important element and it involved in most of the services provided by dental hygienist. **Slide #2** Pictures of a dental professional and dental products containing fluoride. **Q:** In your opinion, do dental professionals need to be aware of potential toxic effects of fluoride? **A:** Answers will vary, but the students will learn that the correct answer is "yes".

TIME	LESSON CONTENT	NOTES
2 minutes	E. Established Knowledge Base Have you ever heard of the term fluoride? Fluoride is a mineral that occurs naturally in soil, water, and air that has been shown to prevent tooth decay.	**Slide #3** Pictures of a tooth and fluoride toothpaste carton
	F. Instructional Objective After today's lecture, you should be able to define the element of fluoride; describe the process of fluoride metabolism in the body; list multiple sources of fluoride; evaluate; a commitment to remain aware of potential toxic effects of fluoride.	**Slide #4** Objectives

TIME	LESSON CONTENT	NOTES
5 minutes	**I. Fluoride**	
	A. Definition: A salt of hydrofluoric acid; the ionized form of fluorine that occurs in many tissues and is stored primarily in bones and teeth.	**Slide #5** What is fluoride? -Picture of natural fluoride element **Note:** This is the fluoride element's official definition from Wilkins book.
	B. Fluorine 1. 13th most abundant element 2. A pale-yellow green gas 3. Rarely found in nature 4. Naturally occurring mineral 5. Released from: a. Soil b. Water c. Air	**Slide #6** What is fluoride? **Note:** As ground water moves through the earth, it passes over rock formations and dissolves the fluoride minerals, this increases the fluoride content of the water.
	C. Concentrations 1. Variable in water a. According to: i. Quantity of fluoride ii. Water depth 2. Toxic in high concentrations 3. Measured in: a. Plasma b. Saliva c. Urine d. Bones e. Nails f. Hair g. Teeth	**Q**: Why do dental professionals need to be educated on this subject? **A**: Since fluoride is an element commonly used in dentistry as a preventive material and used in many dental products.
5 minutes	**II. Fluoride Metabolism**	**Slide #7** Fluoride Metabolism
	A. Fluoride Intake 1. Multiple sources	**Slide #8** Smart art of metabolism process
	B. Absorption 1. Gastrointestinal tract a. In the stomach i. Passive diffusion ii. Hydrogen fluoride (HF) iii. Within 60 minutes	

TIME	LESSON CONTENT	NOTES
	b. By small intestine 2. Blood stream a. Carried by plasma	
	C. Distribution and Retention 1. Distributed by plasma 2. 99% in teeth and bones	**Slide #9** Fluoride Metabolism **Note:** Most fluoride is excreted through the kidneys in the urine, with a small amount excreted by the sweat glands, feces and breast milk.
	D. Excretion 1. Kidneys a. Urine 2. Sweat glands 3. Feces 4. Breast milk	
5 minutes	**III. Fluoride and Tooth Decay**	**Slide #10** Fluoride and Tooth Decay
	A. Preventing of Tooth Decay 1. Maximum caries inhibiting a. Preeruptive exposure b. Posteruptive exposure 2. Reduction in caries a. 27% in permanent teeth b. 40% in primary teeth 3. Caries risk assessment a. Low caries risk b. Moderate caries risk c. High caries risk	**Note:** The use of fluoride provides the most effective method for dental caries prevention and control. **Note:** Fluoride therapy is mostly effective for patients who are at risk for developing dental caries.
	B. Demineralization: 1. Breakdown of tooth structure 2. Loss of minerals a. Calcium b. Phosphorus	**Slide #11** Demineralization and Remineralization **Q:** How does fluoride enhance remineralization? **A:** By absorbing to the crystal surface and attracting calcium and phosphate ions.
	C. Remineralization: 1. Reversal of demineralization 2. Restoration of minerals 3. Enhanced by fluoride 4. Resistant to dental caries	

TIME	LESSON CONTENT	NOTES
	D. Fluoride in Biofilm and Saliva 1. Reservoirs for: a. Fluoride b. Minerals i. Calcium ii. Phosphorus 2. Low concentrations 3. High reminiralization 4. 5-50ppm in biofilm	
3 minutes	**E. Fluoride Mechanism of Action** 1. Inhibit demineralization 2. Enhance Remineralization 3. Inhibit bacterial activity	**Slide #12** Picture of a demineralized teeth **Slide #13** Video of demineralization and remineralization cycle
5 minutes	**IV. Sources of Fluoride**	**Slide #14** Sources of Fluoride
	A. Fluoride in Foods 1. Foods i. Fish ii. Meat iii. Eggs iv. Vegetables and fruits v. Cereals vi. Bottled water vii. Fluoridated salt viii. Fluoridated drinking water ix. Infant formula	**Slide #15** Pictures of food containing fluoride **Slide #16** Pictures of food containing fluoride **Note:** Meat, eggs, vegetables, cereal, and fruits have very small but measurable amounts, whereas tea and fish have larger amounts. **Slide #17** Sources of Fluoride **Q**: What should you consider before recommending the use of fluoride supplements? **A**: The child's age, caries risk, and all sources of fluoride exposure.
	B. Dietary Fluoride Supplements 1. Sodium fluoride supplements a. Tablets b. Lozenges c. Oral drops 2. Dosage a. 0.25 mg b. 0.50 mg c. 1.0 mg	

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	3. For children: a. High risk of dental caries b. Fluoride deficiency **C. Fluoride Mouthrinses** 1. Moderate or high caries risk 2. Limitation: a. Under 6y/o 3. 26% - 29% of caries prevention **D. Fluoride Dentifrices** 1. Basic caries prevention intervention 2. 23% of caries prevention	**Q**: Why do you think mouthwash isn't recommended for kids under the age of six? **A**: Too much fluoride at an early age can cause fluorosis when children's teeth are still forming, and children under this age typically swallow everything instead of spitting it out when done. Once they are show their ability to spit as needed, then they can move on to using fluoridated rinses.
2 minutes	**E. Professional Topical Fluoride Application** 1. Forms a. 2.0% sodium fluoride (NaF) i. Gel ii. Foam b. 1.23% acidulated phosphate fluoride (APF) i. Gel ii. Foam c. 5% sodium fluoride (NaF) i. Varnish 2. Application mode a. Tray b. Soft brush	**Slide #18** Pictures of fluoride gel and varnish
	F. Self-Applied Fluoride 1. Methods a. Tray b. Rinsing c. Toothbrushing	**Note:** Indications for use self-applied fluoride depend on the individual patient prevention needs and caries risk assessment.
2 minutes	**V. Fluoride Toxicity** **A. Lethal and Safe Doses of Fluoride** 1. Certainly lethal dose (CLD) a. Adult: 5-10 g NaF b. Child: 0.5-1.0 g NaF 2. Safety tolerated dose (STD) a. Adult: 1.25-2.5 g NaF b. Child: 500 mg NaF	**Slide #19** Fluoride Toxicity **Slide #20** Graphic of lethal and safe doses of fluoride for selected ages **Note:** Lethal dose is the amount of a drug likely

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		to cause death if not intercepted by antidotal therapy.
2 minutes	**VI. Acute Toxicity** **A. Cause:** 1. Excess dose over short time **B. Signs and Symptoms** 1. 30 minutes to 24 hours 2. Gastrointestinal tract a. Nausea b. Vomiting c. Diarrhea d. Abdominal pain e. Increased salivation f. Thirst 3. Systemic involvement a. Blood i. Hypocalcemia b. Central nervous system i. Hyperreflexia ii. Convulsions iii. Paresthesia c. Cardiovascular and respiratory depression i. Cardiac failure ii. Respiratory paralysis	**Slide #21** Acute Toxicity **Note:** Fluoride in the stomach is acted on by the hydrochloric acid to form hydrofluoric acid, an irritant to the stomach lining.
3 minutes	**C. Emergency Treatment** a. Induce vomiting i. Digital stimulation b. Second person i. Emergency services c. Fluoride-binding liquid i. Milk ii. Milk of magnesium iii. Lime water d. Support respiration and circulation	**Slide #22** Acute Toxicity -Picture of milk of magnesium **Q**: Do you think the fluoride acute toxicity can lead to death? Why? **A**: Yes. Answers to "Why" will vary.

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	VII. Chronic Toxicity	
3 minutes	**A. Cause:** 1. long-term ingestion 2. Excess dose	
	B. Skeletal Fluorosis 1. Causes a. Ingestion i. 8-10 ppm of fluoride ii. 10 or more years b. Industrial fumes or dust 2. Characteristics a. Stiff and painful joints 3. Predisposing factors a. Dietary deficiency b. Fluoride metabolism c. Fluoride exposure 4. Treatment a. Defluorination	**Slide #23** Picture of skeletal fluorosis
3 minutes	**C. Dental Fluorosis** 1. Excess fluoride intake a. Drinking water b. Dental products 2. During tooth development a. From birth to 12 or 16y/o 3. No systemic symptoms	**Slide #24** Picture of dental fluorosis **Note:** All white spots in the enamel are not related to fluoride intake. **Q:** What do you think the difference is between mild fluorosis and other white spots? **A:** Location, distribution, dental and fluoride-intake history.
	D. Mild Fluorosis 1. White opacities in the enamel 2. Young children	
	VIII. Accidental Ingestion	**Slide #25** Fluoride Toxicity
	A. Cause: 1. Concentrated fluoride ingestion	
	IX. Acute Fluoride Poisoning **A. Occurrence:** 1. Follows fluoride toxicity 2. Rare to occur	

TIME	LESSON CONTENT	NOTES
3 minutes	**VIII. CLOSURE** A. Summary of Major Points - Relate Back to Objectives I hope that you now have a better understanding of what fluoride is. I hope that through today's information you have learned what the metabolic process of fluoride is, its sources, its role in helping prevent tooth decay, and its potential toxic effects. Keep in mind to be aware of fluoride toxicity, as it can have injurious effects if used without attention to correct dosage and frequency. Remember that you have a critical role in educating and instructing patients in proper use of fluoride. Provide a Sense of Accomplishment I hope you will be more comfortable and able to recognize the role of fluoride in preventing and controlling caries, how it is metabolized in the body, its multiple sources, and be aware of its potential toxic effects. B. Assignment: For a better understanding of our topic today you should: 1. Explore websites listed on your handout 2. Search magazines for current articles in various journals 3. Research fluoride therapy offered in dental offices in your local area	**Slide #26** Objectives **Q**: What is the role of fluoride in dental caries prevention and control? **A**: Fluoride can prevent dental caries by inhibiting demineralization, enhancing remineralization and inhibiting bacterial activity. **Slide #27** References and Websites to Explore **Note:** Also placed in your handout.

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5 minutes	**CRITICAL THINKING ACTIVITY** **Case:** You have a patient who is a 27-year-old male who has two proximal cavitated lesions and several white spots caused by demineralization of enamel. He states that he uses a daily fluoride toothpaste twice a day and consumes fluoridated water and soda pop daily. He mentions that he doesn't know what the white spots on his teeth are and he is worried about his teeth appearance. Now that you are aware of the relationship between fluoride and tooth decay prevention, its sources, its metabolic process and its potential toxic effects; how will you assess this case, how would you evaluate his risk factors and what information could you tell him about treatment options? 1. How do you assess this patient for fluoride therapy? Answer: The patient at high caries risk as shown by the presence of two proximal cavitated lesions and several white spots caused by demineralization of enamel. He has frequent daily consumption of soda pop which increases the caries risk. Therefore, he needs fluoride therapy to help prevent dental caries and promote his oral health. 2. The patient hears the term of fluoride for the first time and says that he doesn't know the relationship between fluoride and tooth decay prevention, how can you inform the patient of the fluoride material and its role in caries prevention? Answer: You will explain to him that fluoride is a naturally occurring mineral and is stored primarily in bones and teeth. You should describe the relationship between fluoride and	**Slide #28** Critical Thinking Activity: Case for Analysis

TIME	LESSON CONTENT	NOTES
	tooth decay prevention that includes inhibiting demineralization, enhancing remineralization and inhibiting bacterial activity. 3. The patient says he thinks he needs fluoride supplements and believes it will be effective in removing the white spots on his teeth, with your knowledge, what would you tell your patient to make well-informed decisions and advise him of potential toxic effects of fluoride? Answer: Dietary fluoride supplements are available as tablets, lozenges and oral drops and it must be prescribed according to the safe doses. Excess dosage of fluoride can lead to acute or chronic toxicity such as skeletal fluorosis and dental fluorosis. Certain foods contain fluoride such as tea, fish, meat, eggs, fruits and vegetables. In addition, you are using fluoride toothpaste and consuming fluoridated water which helps strengthen the teeth and control dental caries. 4.What are the treatment options you would recommend for this patient? Answer: You will make recommendations to help the patient maintain a good oral health. These could include professional topical fluoride applications such as 5% NaF varnish, 2.0% NaF foam and using fluoride mouthrinse. Discuss the need for the professional topical fluoride applications in six months or three months.	**Q:** What are the signs and symptoms of acute toxicity? **A:** Signs and symptoms include nausea, vomiting, diarrhea, abdominal pain and increased salivation. **Slide #29** Photo of smiling frog drinking cup of tea and said “Tea is high in fluoride”.

Test Questions

1. **Objective #1:** Define the element of fluoride.

   Test Item: Characteristics of the element of fluoride may include the following **EXCEPT** one. Which is the **EXCEPTION**?

   a. Naturally occurring mineral
   b. Toxic in high concentrations
   c. Ionized form of fluorine
   d. Stored primarily in the skin

2. **Objective #2:** Describe the process of fluoride metabolism in the body.

   Test Item: The process of fluoride metabolism in the body may include the following **EXCEPT** one. Which is the **EXCEPTION?**

   a. Absorption
   b. Oxidation
   c. Distribution
   d. Excretion

3. **Objective #3:** List multiple sources of fluoride.

   Test Item: Sources of fluoride include the following **EXCEPT** one. Which one is the **EXCEPTION?**

   a. Multi-vitamins supplements
   b. Fluoridated drinking water
   c. Vegetables and fruits
   d. Sodium fluoride Varnish

4. **Objective #4:** Evaluate the relationship between fluoride and tooth decay prevention.

   Test Item: 6-year old Frank presents for his routine dental hygiene exam. His anterior teeth have white opacities in the enamel surface. No aesthetic or health problems are involved. He lives in a fluoridated area. His mom said he daily uses a fluoride mouthrinse. The dental hygienist examines the patient and made the assumption that the white spots are related to the demineralization process and the patient is at risk of developing dental caries. She recommends Frank's mother continue using a fluoride mouthrinse on him and that he receive a fluoride application. Did the dental hygienist handle this in an appropriate way? Explain your answer.

5. **Objective #5:** Demonstrate a commitment to remain aware of potential toxic effects of fluoride.

Test Item: In one paragraph (3-4 sentences), indicate your personal commitment to maintaining professional awareness of potential toxic effects of fluoride.

Correct Answers:

1. D
2. B
3. A
4. The dental hygienist did not handle this in an appropriate way. He/she should have reviewed the patient's dental and fluoride-intake history, by noting the location and distribution of the white spots, and consider the sequence of tooth development. All white spots in the enamel are not related to tooth caries. The dental hygienist should have diagnosed the patient with mild fluorosis according to patient's age and fluoride-intake. Therefore, fluoride mouthrinse should not be used for patients age 6 or younger as too much fluoride at an early age can cause fluorosis when children's teeth are still forming.

5. As a dental hygienist, I will seek out continuing education courses related to the topic of fluoride toxicity and safety. I will also remain aware of lethal and safe doses of fluoride for adult and children. I will use only researched, recommended fluoride amounts and methods for delivery.

Test Questions

2. **Objective #1:** Identify the basic parts of the dental hygiene care plan.

   Test Item: Basic parts of the dental hygiene care plan may include the following **EXCEPT** one. Which is the **EXCEPTION**?

   a. Preventive care
   b. Dental caries control
   c. Periodontal/gingival health
   d. Informed consent

6. **Objective #2:** List the components of a written dental hygiene care plan.

   Test Item: The components of a written dental hygiene care plan may include the following **EXCEPT** one. Which is the **EXCEPTION?**

   e. Demographic data
   f. Dental charting
   g. Caries Risk Status
   h. Expected Outcomes

7. Objective #3: Determine the factors affecting sequence of patient care.

   Test Item: Factors affecting sequence of patient care include the following **EXCEPT** one. Which one is the **EXCEPTION?**

   a. Treatment plan refusal
   b. Antibiotic premedication
   c. Systemic diseases
   d. Existing etiologic factors

8. **Objective #4:** Apply the procedures for presenting a care plan to the patient and the dentist.

   Test Item: A patient was present for discussion of the formal dental hygiene care plan related to periodontal therapy. He mentioned that this is his first dental hygiene visit, and he doesn't know what periodontal therapy is. What are procedures you will apply for presenting a care plan to him?

1. **Objective #5:** Reflect on the importance of obtaining informed consent from the patient.

   Test Item: In one paragraph (3-4 sentences), indicate the importance of obtaining informed consent from the patient.

Correct Answers:

6. D
7. B
8. A
9. Position the patient in an upright position, face to face with clinician
10. Informed consent is important for an open communication between the oral care provider and the patient and for the protection of legal rights. Informed consent allows shared decision making with oral care provider while treatment is being planned. Patients have the right to receive information and ask questions about recommended treatments so that they can make well-considered decisions about care.