Course: DEN 130

Topic: Calculus and Stain

Audience: Adult Learners (Freshman Level Dental Hygiene Students)

Time: 50 minutes

Materials: Computer, Projector, PowerPoint, Pointer

Instructional Objectives:

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

1. Recognize the factors that influence the accumulation of calculus and stain.
2. Explain the location, composition, and properties of calculus and stain.
3. Describe the clinical and radiographic characteristics of supra- and subgingival calculus and its detection.
4. Differentiate between exogenous and endogenous stains.
5. Design the appropriate clinical approaches for stain removal and maintenance.

References

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TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
3 minutes	**I ANTICIPATORY SET** A. Introduction Maintaining good oral health requires understanding the factors that contribute to the accumulation of dental calculus and stains, such as their location, composition, and properties. It is also essential to identify how they attach to the teeth and how to detect their presence. Failure to address these issues can result in changes to the tooth structure and overall oral health. B. Gain Attention / Motivate If a patient asks why brushing their teeth won't remove the hard yellow hard stuff from their teeth can you provide a detailed explanation for them? C. Activate Prior Knowledge Have you ever wondered why tartar develops so quickly on teeth? Why does it accumulate on the back of the lower front teeth and front of the upper molars? D. Establish Rationale By being here today for this class, you show great responsibility to the dental community you will serve as a health professional. E. Present Instructional Objectives 1. Recognize the factors that influence the accumulation of calculus and stain (biofilm). 2. Explain the location, composition, and properties of calculus and stain. 3. Describe the clinical and radiographic characteristics of supra- and subgingival calculus and its detection. 4. Differentiate between exogenous and endogenous stains. 5. Determine the appropriate clinical approaches for stain removal and maintenance.	Slide #1: Calculus (title) Note: Calculus develops from nonmineralized biofilm. Slide #2: What is calculus? Q. In your opinion, do you think proper oral hygiene care can prevent all calculus formation? A. Proper oral hygiene care can reduce the formation of calculus but may not prevent it completely; genetics, diet, and overall health can play a role. Slide #3: Objectives

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
3 minutes	**II. Calculus** A. Definition of calculus: dental biofilm mineralized by crystals of calcium phosphate mineral salts between previously living microorganisms. 1. Calculus characteristics a. nonmineralized biofilm b. tenacious mass forms **III. Supragingival Calculus** A. Location 1. above the margins 2. crowns, implants, partials, B. Distribution: frequent locations 1. lower anterior (lingual) 2. facial/buccal of upper molars 3. submandibular and parotid gland 4. teeth out of occlusion 5. teeth challenging to reach (3rd molars) **IV. Subgingival Calculus** A. Location 1. apical to gingival margin 2. dental implants B. Distribution 1. generalized/ localized 2. heavy in hard-to-reach areas 3. cementoenamel junction a. recession b. color from products of blood **V. Calculus Composition** A. Inorganic, organic, water 1. percentages vary a. age b. hardness c. location 2. mature calculus a. inorganic components b. organic c. water	Slide #4**:** Classification and distribution of calculus (title) Slide #5**:** Supragingival Q. Why do you think teeth that are misaligned are more likely to accumulate calculus? A. Misaligned teeth can make it harder to reach certain areas of the mouth with a toothbrush or floss, leading to more plaque and calculus buildup. Slide #6**:** Subgingival Note**:** Subgingival calculus can cause boneless around implants. Slide #7: Supra and subgingival calculus (image) Slide #8 Composition of calculus (title) Slide #9**:** Composition of calculus

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
3 minutes	B. Major Inorganic Content 1. main components a. calcium b. phosphorus c. carbonate d. sodium e. magnesium C. Trace Elements 1. copper 2. zinc 3. strontium 4. manganese 5. silicone 6. fluorine 7. iron 8. potassium D. Fluoride in Calculus 1. hydroxyapatite (supra) 2. concentration depends on: a. exposure to fluoride b. topical fluoride c. dentifrices (toothpastes) d. contact with surfaces E. Crystals 1. four types of calcium phosphate crystals a. brushite b. octocalcium phosphate c. hydroxyapatite (mostly) d. whitlockite	Slide #10**:**Calculus composition-inorganic content **Note:** Tartar control toothpaste and mouthwash can decrease the amount of accumulation if used properly. Slide #11**:** How does calculus form? (title)
1 minute	F. Composition of Calculus 1. enamel most highly mineralized tissue a. 95-97% inorganic salts 2. dentin a. 65% inorganic salts 3. cementum a. 45-70% inorganic salts 4. subgingival calculus a. average mineral content 58% with max 60-80% G. Organic content 1. various types of microorganisms a. desquamated epithelial cells b. leukocytes	Q. Which substance is the hardest and contains the most mineralized tissue? A. Enamel Slide #12: Calculus Composition- Organic

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
	c. mucin from saliva	
2 minutes	**VI. Calculus Formation: deposition of minerals into a biofilm organic matrix.**	Slide #13: Calculus formation (title)
	A. Factors in Rate	
	1. genetic and saliva composition	
	a. heavy-higher levels of calcium	Slide #14: Factors in rate of formation
	b. three-time more phosphorus	
	2. diet (alkaline, high in silicon)	
	a. rice and refined carbs	Q. What other factors other than the ones listed can affect the rate of calculus accumulation?
	3. variations in bacterial load	
	4. age, race, and gender	
	5. severity of periodontal disease	
	6. crowing of teeth	
	7. low levels of s. mutants	A. Answers will vary—poor oral hygiene, smoking, and dry mouth
	B. Calculus Mineralization	
	1. biofilm	
	2. supragingival microorganisms (right angle)	
	3. subgingival cocci, rods and filamentous (no pattern)	Slide #15**:** Calculus mineralization
	C. Mechanism of Calculus Mineralization	
	1. supersaturation	
	2. dead microorganisms degrade and Mineral deposition begins	Slide #16: Mechanism of calculus mineralization
	3. calcium binds to phospholipids	
	4. Stable phase occurs approx. eight months	
	5. forms in layers	
	a. layers heterogeneous with different minerals (supra)	
	b. layers homogenous with equal mineral (sub)	
1 minute	D. Types of Calculus Deposits: The surface is typically rough and detected with an explorer. The veneer type is smooth and difficult to detect with an explorer.	Slide #17: Clinical characteristics of calculus (table)
	1. crusty, spiny, or nodular deposits	
	2. ledge or ring formation	
	3. thin, smooth veneers	
	4. finger and fern-like formations	
	5. islands or spots	
	E. Formation Time	Slide #18: Calculus formation time
	1. average 12 days	
	2. half in the first two days with poor OH	

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
2 minutes	3. depends on other factors (age, diet, etc.) **VII. Attachment of Calculus** A. Acquired pellicle B. Minute irregularities C. Direct contact with tooth surface **VIII. Clinical Implications of Calculus** A. Clinical calculus is always covered with biofilm B. Secondary factor for periodontitis C. Apically reason for increased pockets and attachment loss D. Removal results in healing **IX. Clinical Characteristics** A. Direct Exam: indirect or direct B. Compressed Air: invisible on wet tooth C. Subgingival 1. visual exam a. dark edges b. gentle air to the gingival margin 2. tissue color a. dark shadow 3. tactile exam a. probe b. explorer 4. radiographic exam 5. dental endoscopy a. deep pockets and furcation b. burnished or veneer type	Slide #19: Attachment of calculus (title) Slide #20: Clinical implications of calculus Q. Is it possible to remove all calculus and bacteria? A. No Note: Using compressed air and good lighting is essential to identify small pieces of calculus. Slide #21: Clinical characteristics Slide #22: How to detect calculus. Slide #23: Supragingival examination (image) Slide #24: Subgingival examination (image) Slide #25: Subgingival exam cont. (pic of radiograph)
1 minute	**XI. Prevention of Calculus** A. Biofilm Control 1. brushing, flossing, rinsing B. Oral Hygiene Instruction 1. hands-on 2. recall appts 3. nutrition C. Anticalculus Dentifrice 1. goal a. prevents calculus b. no effect on existing c. prevent formation d. motivate	Slide #26: Calculus prevention

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
4 minutes	e. supplement to mechanical biofilm removal D. Chemotherapeutic Anticalculus Agents 1. mineralization inhibitors a. pyrophosphates b. zinc citrate **XII. Dental Stains and Discoloration** A. Occurs in three ways 1. on tooth surface 2. in calculus or pellicle 3. tooth structure or restorative material B. Significance 1. appearance 2. detrimental effects 3. evaluating oral self-care C. Classification 1. location a. extrinsic b. intrinsic D. Classified by Source 1. exogenous 2. endogenous E. Recognition and identification 1. medical and dental history a. developmental delays b. medications c. tobacco d. marijuana e. betel or areca nut f. fluoride 2. food diary a. tea, coffee, dark juices, wine 3. oral hygiene habits a. self-care routines F. Application of Procedures for Removal 1. directly on tooth surface a. toothbrushing or interdental b. debridement or polishing 2. tenacious a. avoid excess polishing i. abrasion ii. removal of fluoride layer iii. overheating 3. within acquired pellicle a. toothbrush and interdental	**Q.** Does calculus cause periodontal disease? **A**. No, biofilm does. Slide #27: Dental Stain and discoloration(title) Slide #28: What is stain? Slide #29: Significance of dental hygiene practice (four images) Slide #30: Stain Classification Slide #31: Recognition and identification **Note:** Betel or areca nuts are used for chewing tobacco. Slide #32: Procedures for stain removal

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
	4. inside the tooth a. whitening b. microabrasion	
2 minutes	c. porcelain veneer or crowns	
	XIII. Extrinsic Stains (yellow, green, black, line, tobacco, orange, red, metallic)	Slide #33: Extrinsic stains
	A. Direct 1. compounds 2. organic chromogens	
	B. Indirect 1. chemical interactions	
	C. Yellow Stain	Slide #34: Yellow stain
	1. features a. dull, yellowish 2. distribution a. generalized b. localized 3. occurrence a. older adults b. poor oral hygiene	
	4. etiology a. dietary b. tobacco	Slide #35: Green stain Q. What are some important factors to help prevent green stains?
2 minutes	D. Green Stain 1. features a. light or yellowish green b. very dark green 2. distribution a. facial gingival third b. maxillary anterior teeth 3. composition a. chromogenic bacteria b. decomposed hemoglobin c. Inorganic elements i. copper ii. nickel iii. other elements, small amounts 4. occurrence a. any age (childhood) b. permanent and primary 5. recurrence a. oral hygiene dependent 6. etiology a. poor oral hygiene	A. Good oral hygiene, routine dental checkups, avoiding habits like tobacco, foods, and drinks that cause stains. **Note:** Other products that can cause green stains include spinach, smoothies, kale, matcha powder, spirulina, and algae. Certain food dyes and colorings used in processed foods, beverages, and candies can also leave green stains.

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
4 minutes	b. biofilm retention c. chromogenic bacteria d. gingival hemorrhage 7. Clinical Approach a. toothbrush b. least abrasive polish 8. Other Green Stain a. chlorophyll b. metallic dust c. green tea d. drugs, marijuana E. Black Line Stain: retentive black or brown calculus-like stain that forms along gingival third near gingival margin. 1. other names a. pigmented biofilm b. brown stain c. black-stain 2. clinical Features a. line formed on pigmented spots b. 1-mm wide c. may occupy entire gingival third d. black at bases of pits and fissures e. lower caries with children with black line stain 3. distribution a. facial and lingual b. rare on facial surfs of upper anterior teeth c. most frequent i. lingual and proximal surfaces ii. maxillary posterior teeth iii. occlusal pits 4. composition and Formation a. chromogenic microorganisms b. pellicle-like structure 5. occurrence a. increases with age 6. recurrence (personal care) 7. predisposing Factors a. actinomyces	Slide #36: Black Line Stain **Note:** There is a correlation between the presence of black line stain and low caries experience. Q. What are the compounds associated with black line stain? **A.** Iron, copper, and sulfur

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
	b. diet c. iron supplements	
2 minutes	F. Tobacco Stain 1. clinical features a. light brown-dark brown or black b. incorporated in calculus c. heavy may penetrate enamel 2. distribution a. diffuse staining of biofilm b. narrow band (gingival crest) c. wide, firm, tar-like band 3. composition a. tar and products of combustion b. brown pigment 4. predisposing factors a. smoking or chewing tobacco b. poor oral hygiene c. extent of biofilm and calculus	Slide #37: Tobacco stain **Q.** Other than explaining the health concerns it can cause, what are some things that can influence a patient to stop smoking in the dental chair when they are concerned about tobacco stains? **A.** Show the condition of the teeth by using an intraoral camera and a hand mirror to visualize the stain and give them a smoking cessation pamphlet or number to call.
2 minutes	G. Brown Stains 1. clinical features a. chemical alterations b. buccal of upper molars c. lingual of lower anterior 2. predisposing factor a. poor oral hygiene b. tea, coffee, soy sauce 3. stannous fluoride a. light brown, yellowish b. minimal after six months c. stannous sulfide d. brown tin oxide 4. antimicrobial agents a. chlorhexidine b. chromogenic polyphenols i. coffee ii. tea iii. wine c. brown on tongue and teeth d. forms on exposed roots e. clinical implication (cannot remove) i. enamel defects ii. anterior composite iii. crown iv. veneer type restorations	Slide #38: Brown stains **Note:** Chlorhexidine is a common antimicrobial mouth rinse prescribed to patients undergoing dental procedures such as extractions, implants, and periodontal surgery. It is given regularly to help prevent infection and promote healing after surgery.

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
2 minutes	H. Beta/ Areca: a seed of Areca catechu, a type of palm tree 1. quid 2. dark mahogany 3. sometimes black 4. laminated pattern like subgingival I. Swimmer Stain 1. chlorine or bromine 2. yellowish, dark brown 3. facial of upper and lower incisors J. Orange and Red Stains 1. appearance a. orange or red b. cervical third 2. distribution a. anterior 3. occurrence a. rare (red more than orange) 4. etiology a. blood and other pulp tissue b. pigments decomposed hemoglobin K. Metallic Stains 1. appearance a. copper or brass (green or bluish green) b. iron (brown to greenish brown) c. nickel (green) d. cadmium (yellow or golden brown) 2. distribution a. primarily anterior b. cervical third most common 3. manner of formation a. aerosolized metallic dust b. metal to pellicle c. prevention: wear a mask	**Q.** When you see dark mahogany, what is an important question to ask the patient? **A.** Do you chew tobacco? Slide #39: Swimmer stain Slide #40: Orange and red stains **Note:** Prior trauma on a tooth can cause discoloration over time. Slide #41: Metallic stains Slide # 42: Endogenous intrinsic stain
2 minutes	**XII. Endogenous Intrinsic Stains** A. Pulpless or Traumatized Teeth 1. not all discolor 2. appearance a. light yellowish-brown b. slate gray	Slide #43: Pulpless or Traumatized Tooth (image)

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
	c. reddish-brown d. dark brown e. bluish black f. black g. orange h. greenish tinge 3. etiology a. pulp tissue elements b. pigments B. Disturbances in Tooth Development 1. period of development 2. genetic abnormality 3. environmental influences	Slide #44: Disturbances in tooth development Slide #45: Developmental enamel defects **Q.** Is it possible to prevent Amelogenesis and Dentinogenesis?
3 minutes	C. Hereditary: Genetic 1. amelogenesis imperfecta 2. dentinogenesis imperfecta D. Developmental Enamel Defects 1. enamel hypoplasia 2. enamel opacity 3. molar-incisor hypomineralization a. generalized hypoplasia b. localized hypoplasia 4. appearance a. erupt with spots, pits, or grooves b. prone to extrinsic stain 5. etiology a. trauma or infection b. rubella infection c. drug intake during pregnancy d. preterm birth e. hypocalcemia	**A.** Amelogenesis and Dentinogenesis are genetic disorders that can affect the development of teeth. There is no known way to prevent these conditions. **Note:** Amelogenesis imperfecta is a condition where enamel formation is disrupted in all teeth, affecting both primary and permanent dentitions.
	E. Dental Fluorosis: brown stain by Dr. Mckay 1. etiology a. enamel hypomineralization b. severity related to age 2. fluorosis classification (chapter 34) 3. appearance a. chalky white spots to brown b. cracks or pitting F. Drug-Induced Stains and Discoloration 1. tetracycline a. affinity for calcium b. fourth month of pregnancy	Slide #46: Dental fluorosis Slide #47: Drug-induced stains

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
3 minutes	c. etiology (dosage, time, type) d. appearance i. generalized or localized ii. light green to dark yellow iii. gray brown iv. with or without banding 2. minocycline: intrinsic before eruption a. appearance (permanent) i. blue-gray ii. gray staining b. etiology **XIII. Exogenous Intrinsic Stains: comes from an outside source.** A. Internalized discoloration 1. sources a. developmental defects b. tooth wear and recession c. dental caries d. restorative materials B. Restorative Materials 1. silver amalgams a. gray/black around restoration b. tin migrates into enamel and dentin 2. endodontic therapy a. cervical third of crown b. materials from endo c. endo sealers orange red/gray d. endo medicaments dark brown e. Portland cement gray f. antibiotic pastes i. tetracycline ii. ciprofloxacin iii. metronidazole iv. minocycline green brown C. Stain in Dentin 1. carious lesion 2. arrested decay 3. secondary dentin black stain 4. hard and glossy 5. cannot remove	Slide #48:Exogenous intrinsic stain (title) Slide #49: Internalized discoloration **Q.** Can you think of a type of fluoride that causes stains? A. SDF Slide #50: Restorative materials that cause stain **Note:** An amalgam tattoo is caused by the deposition of amalgam (silver filling) particles in the tissue.

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
1 minute	D. Other Local Causes 1. enamel erosion a. acidic foods b. eating disorders c. gastroesophageal reflux 2. attrition **IX. Documentation** A. Patient records include: 1. description of appearance 2. extent of supra and subgingival 3. record color, type, extent, location 4. patient care procedures	Slide #51: Other local causes **Note:** Examples of acidic foods and drinks, citrus fruits, soda, and vinegar; eating disorders, bulimia or anorexia. Slide #52: Documentation Q. Why is it important to maintain detailed patient records in dentistry? A. Track the patient's progress, future treatment planning, legal documents, and aid in malpractice lawsuits.

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
2 minutes	**Summary:** I hope you now have a better understanding of what calculus and stains are and how they can affect the structures of the teeth. By recognizing the factors that influence dental calculus and stain, understanding its location, composition, and properties, identifying its modes of attachment, and detecting it, we can take the necessary steps to maintain good oral health.	Slide #53: Summary Note: Thank the learners for their attention and participation. Q. From our lecture today, what resonated with you the most? A. Answers will vary. If misconceptions are noticed, provide clarity.

TIME	LESSON CONTENT	NOTES – MEDIA—Q/A
5 minutes	**Critical Thinking Activity:** **Case:** A new patient, aged 33, is seated in your dental chair and expresses concerns about the color of his teeth. He has not visited a dentist since high school, indicating that he is overdue for a cleaning. Upon reviewing his medical history, you discover he is a smoker. 1. After considering the several factors that can cause stains, what steps and questions will you ask and take to achieve the best outcome for the patient? **Answer**: I would inquire more about the patient's dietary habits, tobacco consumption (how many packs per day), and oral hygiene routine. After conducting a comprehensive examination that includes radiographs, probing, and a clinical and visual assessment, the dentist will determine the treatment required. We can then discuss various treatment options with the patient based on his needs and preferences. 2. After presenting the best treatment options for the patient, he says he does not have the finances to complete all treatment needs but wants to have his teeth whiter. **Answer**: If there are no periodontal concerns, a thorough cleaning can remove some of the external stains caused by smoking, tea, coffee, etc. If the patient is still unsatisfied with the results, recommend an over-the-counter whitening system, but explain how to use it properly and what to expect. Additionally, highlight the disadvantages of not having the other treatment done (fillings, crown, etc.).	Slide #54: Critical Thinking Case

Test Items

Objective #1: Recognize the factors that influence the accumulation of calculus and stain.

Test item #1: Which of the following is **NOT** a factor influencing the accumulation of calculus and stain on teeth?

A) Poor oral hygiene

B) Regular brushing and flossing

C) Genetics

D) Eating sugary food regularly

Objective #2: Explain the location, composition, and properties of calculus and stain.

Test item #2 Which of the following is a hard deposit that forms on the teeth due to plaque buildup?

A) Stain

B) Cavity

C) Biofilm

D) Calculus

Objective #3: Describe the clinical and radiographic characteristics of supra- and subgingival calculus and its detection.

Test item #3: Which of the following is the **MOST** frequent location for supra-gingival calculus?

A. Occlusal surfaces of molars

B. Lingual of lower anterior teeth

C. Cementoenamel junction

D. Dental implants

Object #4: Differentiate between exogenous and endogenous stains.

Test item #4: Explain the differences between exogenous and endogenous stains in one paragraph (3-4 sentences).

Objective #5: Determine the appropriate clinical approaches for stain removal and maintenance.

Test item #5: In one paragraph (3-4 sentences), create your best clinical approach for removal and maintenance for a patient with brown stain.

Correct Answer Key:

1. B
2. D
3. B
4. Exogenous stains are caused by external factors, such as food, drink, or smoking. A dental cleaning or whitening system can remove these stains. Endogenous stains are caused by internal factors that impact the tooth structure, such as medication or genetics. These stains are difficult to remove and may require dental treatment. Understanding the difference between the two will help determine the appropriate treatment needs.

5. The best clinical approach for removing and maintaining brown stains involves dental cleaning and good oral home care. The professional cleaning will include instruments specific to the patient's needs. After the cleaning, oral hygiene instructions include proper brushing techniques, whitening toothpaste and mouthwash, flossing, and avoiding foods and drinks that cause stains.