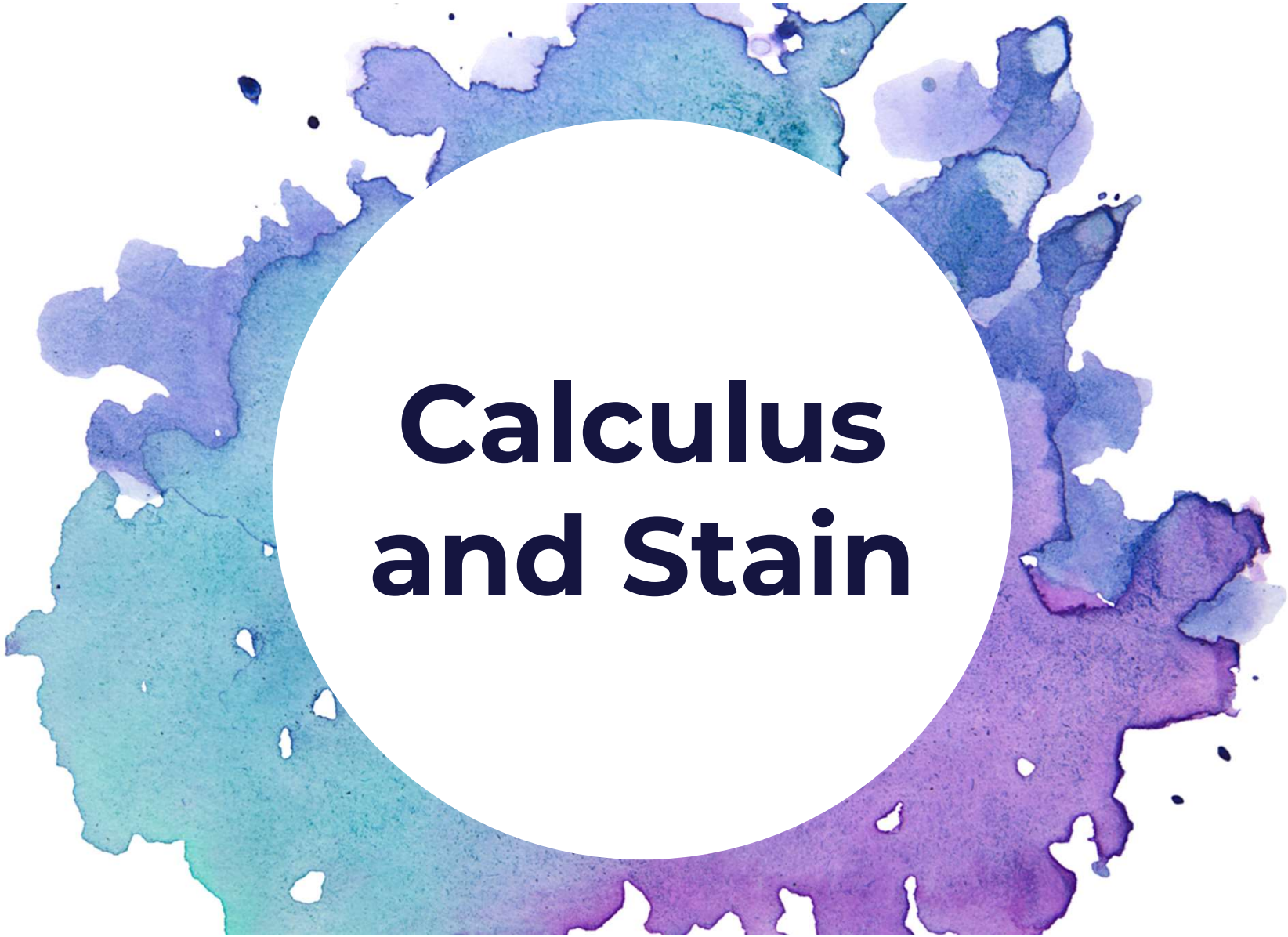

Calculus
and Stain

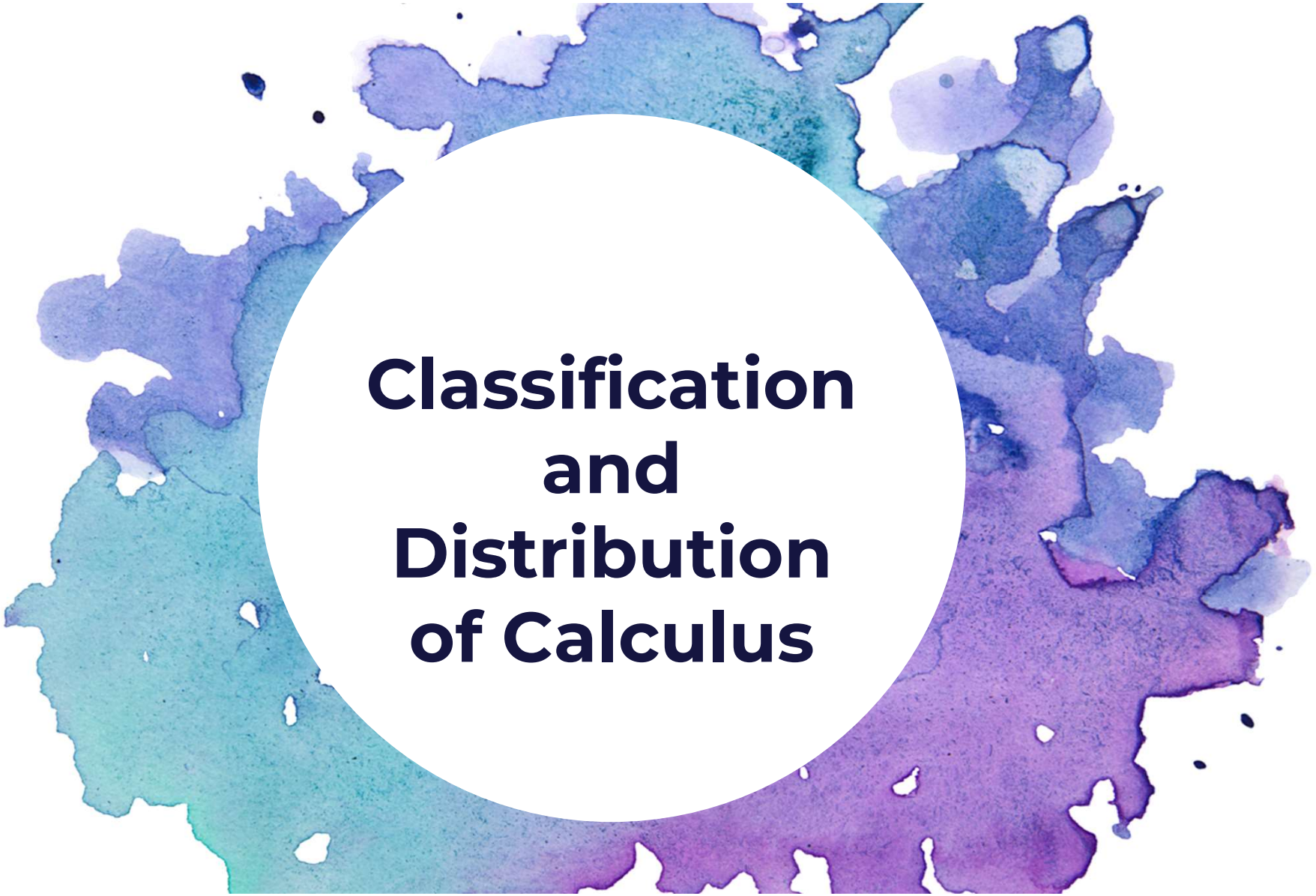
What is calculus?

Calculus is dental biofilm mineralized by crystals of calcium phosphate mineral salts between previously living microorganisms.

- Dental calculus develops when nonmineralized biofilms, rich in oral bacteria, become mineralized with calcium phosphate mineral salts.
- These mineralized biofilms form and are classified by their location above and below the gingival margin (supra and subgingival)
- Nonmineralized biofilm entraps particles from the oral cavity that consist of large amounts of oral bacteria, human proteins, viruses, and food remnants and preserves their DNA.

Objectives

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. Determine the appropriate clinical approaches for calculus and stain removal.


Classification
and
Distribution
of Calculus

Supragingival Calculus

Supragingival calculus is located on clinical crowns **coronal** to the margin of the gingiva, on implants, and on complete or partial dentures.

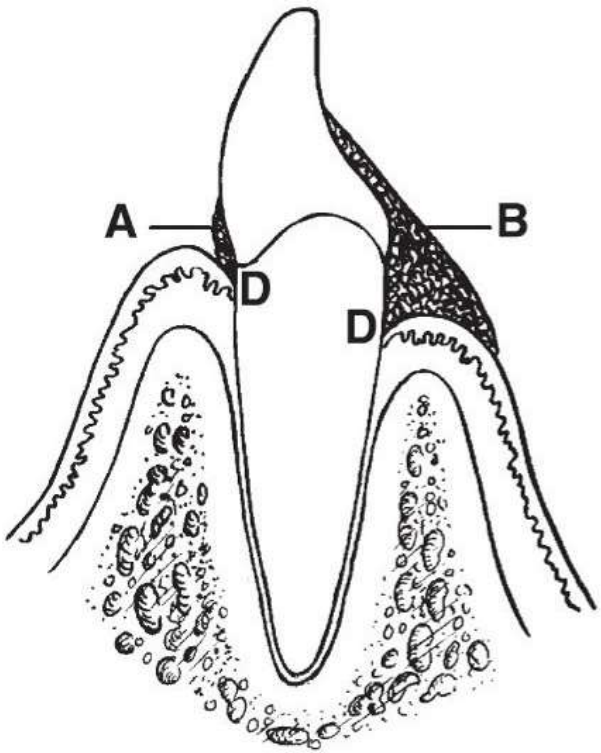
Most frequently found on the lingual surfaces of the mandibular anterior teeth and on the buccal of the maxillary first and second molars

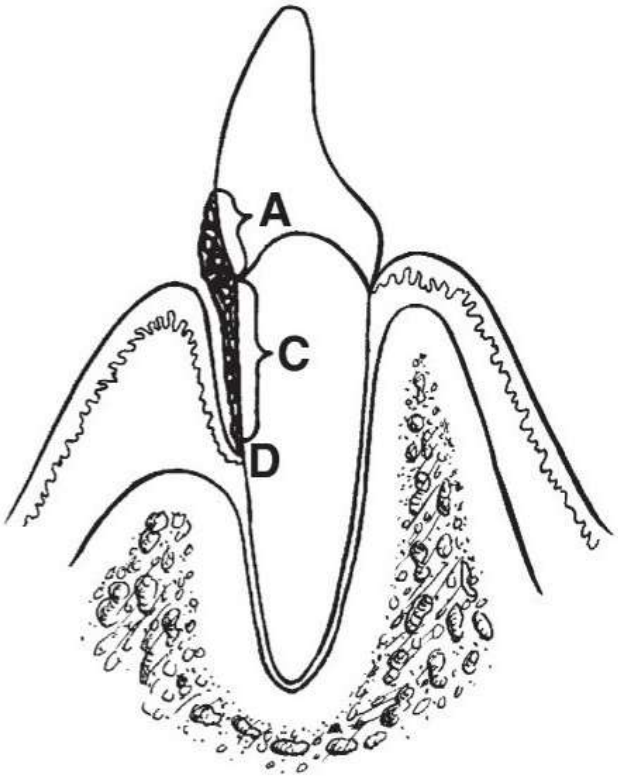
Also found on the crowns of teeth out of occlusion, nonfunctioning teeth, or teeth neglected during oral hygiene.

Talk about pt who comes in 3 to 4 months to control because she avoids that side.

Subgingival Calculus

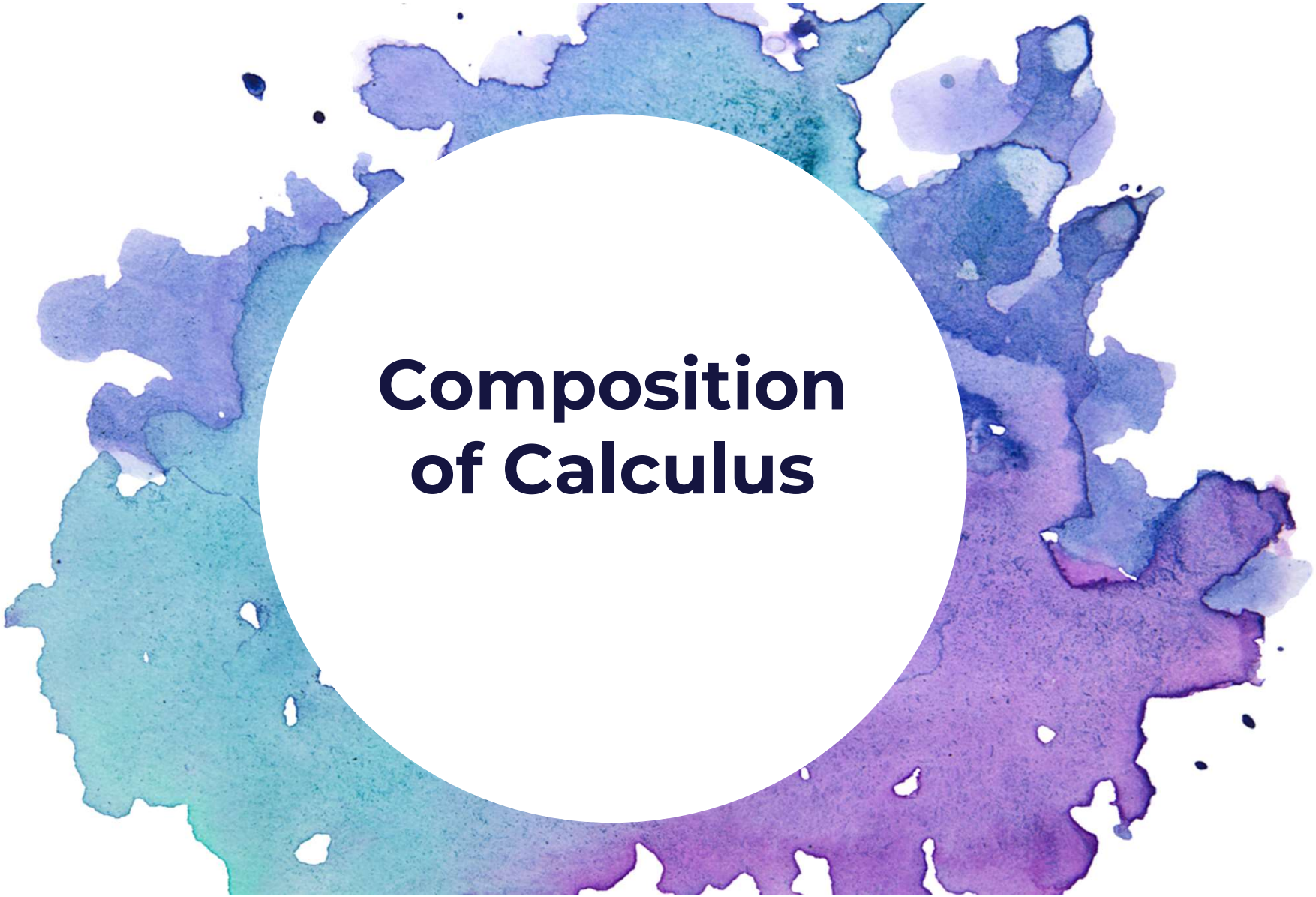
- Subgingival calculus is located **apical** to the margin of the gingiva and extends nearly to the clinical attachment on the root surface and on dental implants.
- Heaviest deposits are related to areas most difficult for the patient to access during oral homecare
- May be generalized or localized (On one tooth or on several teeth, on one portion of the mesial surface, or on most of the mesial surface)





A. On the cervical third **B**. Over the crown, exposed root surface, and margin of the gingiva

B. **C**. Along the root to the base of the pocket **D**. Base of pocket


Composition
of Calculus

Calculus Composition

- Composed of inorganic and organic components and water.
- The percentages vary depending on the age of the deposit, hardness, location, etc.
- Inorganic components come into play with mature calculus.

✓ The rate of calculus formation and its composition may differ depending on the location in the oral cavity.

✓ Calculus close to salivary ducts contain more calcium and phosphorus

Calculus Composition – Inorganic Content

- Major components:
  - calcium, phosphorus, carbonate, sodium, and magnesium
- Trace Elements:
  - zinc, strontium, manganese, silicon, fluorine, iron, and potassium
- Fluoride- is present primarily as part of hydroxyapatite in supragingival calculus
- Dental calculus contains four types of calcium phosphate crystals:
  1. Brushite
  2. Octocalcium
  3. Hydroxyapatite
  4. Whitlockite

How does calculus form?

Calculus Composition-Organic

Organic content

Several types of microorganisms

- desquamated epithelial cells
- leukocytes

Calculus Formation

Factors in Rate of Calculus Formation

- Genetic and individual variation in saliva composition and flow
- *Heavy formers, saliva contains higher levels of calcium and three times greater levels of phosphorus than light calculus formers*
- Diet, especially alkaline food, foods high in silicon like rice, and refined carbohydrates (pizza, candy, rice, bread)
- Age, Race, and Gender
- Misaligned teeth (*recommend orthodontics*)

Calculus Mineralization

- biofilm
- supragingival microorganisms (right angle)
- subgingival cocci, rods, and filamentous (no pattern)

Mechanism of Calculus Mineralization

1. supersaturation

2. dead microorganisms degrade, and mineral deposition begins

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)

Calculus Deposits Classification			
spicules	ledge	ring	projections
			

Wake Tech Class	Description
0	None to grainy (supra or sub) calculus – less than 10 pieces throughout mouth
1	Chalky white supragingival calculus; Localized Grainy/ Small Spicules (supra or sub) on at least 10 surfaces throughout mouth of size 1 pieces (at least 4 must be posterior)
2	Small clickable (supra or sub) ledges on at least 12 surfaces throughout mouth of size 2 pieces (at least 6 must be posterior)
3	Generalized (supra & sub) ledges; Localized (supra & sub) rings; Explorer may catch or hang on subgingival pieces on at least 14 surfaces within two quadrants of size 3 pieces (ex. Quads 1 & 4 14+ pieces) (at least 10 must be sub posterior)
4	Visible (supra) ledges around teeth; Heavy (sub) bridges; Fingerlike (sub) projections; Possibly covering occlusal surfaces on at least 14 surfaces within two quadrants of size 4 pieces (ex. Quads 1 & 4 14+ pieces) (at least 10 must be sub posterior)

Calculus Formation Time

- Average 12 days
- Half in the first two days with poor oral hygiene
- Depends on other factors (age, diet, etc.)

Attachment of calculus

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

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

Clinical Characteristics

- The major objective of nonsurgical periodontal therapy (NSPT) is to prepare the teeth to have biologically acceptable smooth surfaces to facilitate healing and prevent the recurrence of disease.

- **A comprehensive understanding** of the characteristics, origin, development, and methods of prevention of calculus is essential to patient examination, assessment, treatment, and instruction.

- For successful treatment and prevention, the **patient must understand** the relationship between biofilm, calculus, and oral health, the need for complete removal, and the reason for meticulous procedures.

Supragingival Examination

Supragingival deposits may be seen directly or indirectly, using a mouth mirror.

The use of compressed air and good lighting is **essential** to identify small pieces of calculus.

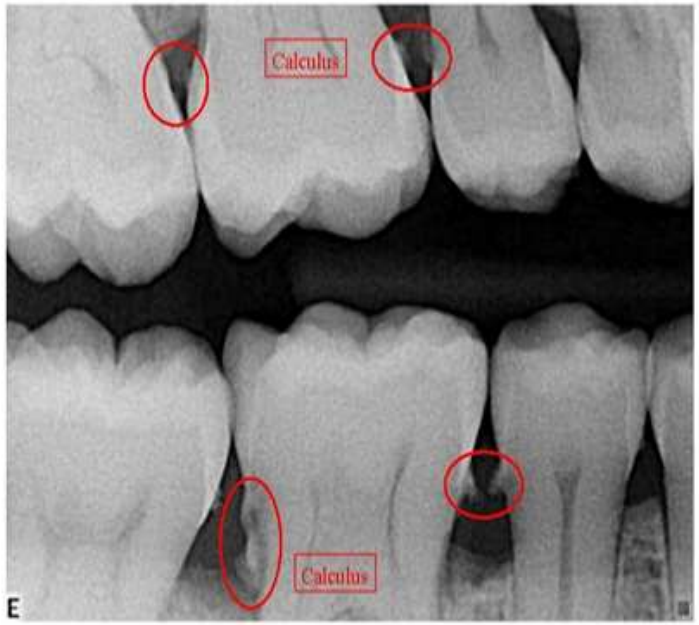
Subgingival Examination

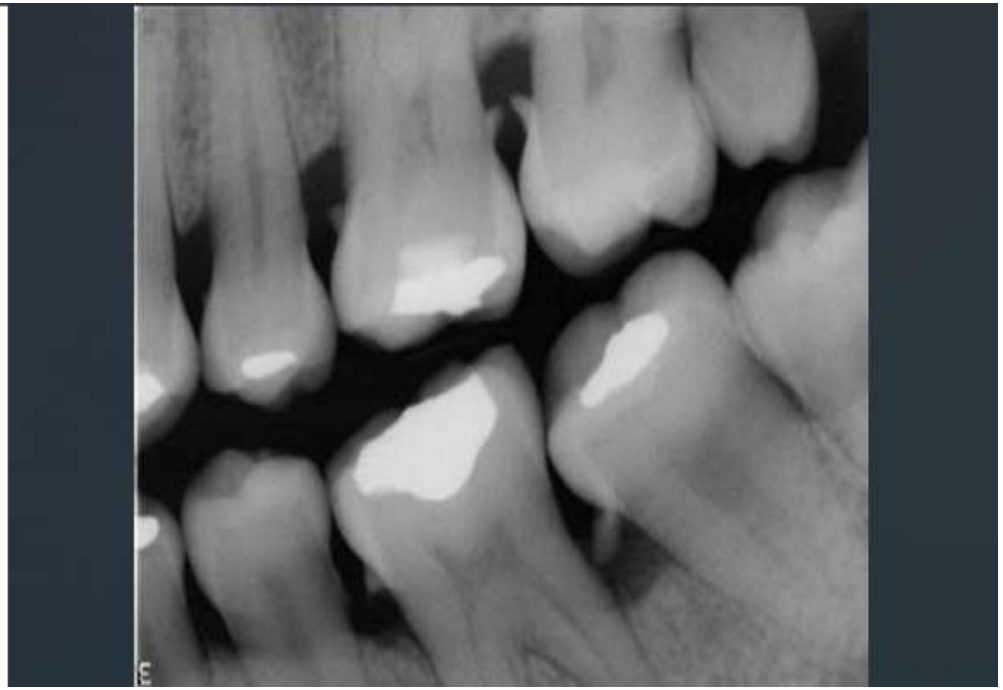
1 Visual Examination
Dark edges of calculus may be seen just beneath the gingival margin

Using **transillumination**, a dark, opaque, shadow-like area seen on a proximal tooth surface may be subgingival calculus - enamel is naturally translucent

2 Gingival tissue color change

Subgingival Calculus In Radiographs





Calculus Prevention

- 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


Stain

What is Stain?

Stain is the discoloration of the teeth and restorations which occur by:

1. Adhering directly to the tooth surface
2. Contained within calculus and soft deposits
3. Incorporated within the tooth structure or the restorative material

Significance for Dental Hygiene Practice

Stain is primarily cosmetic.

External stains can provide a rough surface for biofilm to collect, increasing the risk of gum disease.

Can provide a means of evaluating patient's oral care habits.

External Stains can be prevented!

Classification by Location

Extrinsic

- On the external surface of the tooth
- Removed by brushing, scaling, and/or polishing

Intrinsic

- Occurs due to changes in structural composition or thickness of the enamel.
- Internalize discoloration: extrinsic stain is internalized into the tooth after development
- Occurs in developmental defects and acquired defects like restorative materials.
- Removed by external or internal bleaching or replacement of restorative material (Bleaching reviewed in Dental Materials)

Recognize and Identify

- More than one type of stain may occur
- More than one etiologic factor may be the cause

    - Evaluate medical/dental history, food record, and oral hygiene habits

- How is the type of stain you're dealing with removed?
    - Stains in biofilm?
    - Stains in calculus?
    - Stains within tooth?

Procedures for Stain Removal

1. directly on tooth surface
   toothbrushing or interdental--debridement or polishing
2. tenacious
   avoid excess polishing—abrasion--removal of fluoride layer-overheating
3. within acquired pellicle
   toothbrush and interdental
4. inside the tooth

   whitening --- microabrasion---porcelain veneer or crowns

Extrinsic Stains

There are two categories:

- Direct extrinsic stains caused by compounds, organic chromogens, attach to the pellicle

- Indirect extrinsic stains result from chemical interaction with the tooth surface, that creates a colored stain.

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

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
        copper—nickel---other elements---small amounts

Black line Stain (black)

1. Features
    a. line formed on pigmented spots (1 mm wide)
    b. may occupy entire gingival third
    c. black at bases of pits and fissures
    d. lower caries with children with black line stain
2. Distribution
    a. facial and lingual (rare on facial surfs of upper anterior teeth)
    b. most frequent (lingual and proximal surfs, maxillary posterior, occlusal pits
    b. maxillary anterior teeth
3. Composition
    a. chromogenic microorganisms
    b. pellicle-like structure

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

Brown Stain

1. clinical features

chemical alterations—buccal of upper molars---lingual of lower anterior

2. predisposing factor

poor oral hygiene—tea, coffee, soy sauce

3. stannous fluoride

light brown, yellowish—minimal after six months—stannous sulfide—brown tin oxide

4. antimicrobial agents

chlorhexidine-- chromogenic polyphenols—coffee, tea, wine

Swimmer Stain

1. chlorine or bromine
2. yellowish, dark brown
3. facial of upper and lower incisors

Orange and Red Stain

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

Metallic Stain

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

Endogenous Intrinsic Stain

Pulpless or Traumatic Teeth

1. Pulpless or Traumatized Teeth
    a. not all discolor
2. appearance
    a. light yellowish-brown
    b. slate gray
    c. reddish-brown
    d. dark brown
    e. bluish black
    f. black
    g. orange
    h. greenish tinge

3. etiology
    a. pulp tissue elements
    b. pigments

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

Dental Fluorosis: brown stain

1. etiology

-enamel hypomineralization

-severity related to age

2. fluorosis classification

3. appearance

-chalky white spots to brown

-cracks and pitting

Drug Induced Stains and Discoloration

Tetracycline

a. affinity for calcium
b. fourth month of pregnancy
c. etiology (dosage, time, type)
d. appearance

generalized or localized-- light green to dark yellow– gray-brown--with or without banding

Minocycline: Intrinsic before eruption

a. appearance (permanent)
blue-gray
gray staining

Exogenous Intrinsic Stains: from outside source.

Internalized Discoloration

Sources

- developmental defects
- tooth wear and recession
- dental caries
- restorative materials

Restorative Materials

Silver amalgams

- gray/black around restoration
- tin migrates into enamel and dentin

Endodontic Therapy

- cervical third of crown
- materials from endo
- endo sealers orange red/gray
- endo medicaments dark brown
- Portland cement gray
- antibiotic pastes

Stain in Dentin

- carious lesion
- arrested decay
- secondary dentin black stain
- hard and glossy
- cannot remove

Other local Causes

1. enamel erosion

a. acidic foods
b. eating disorders
c. gastroesophageal reflux

2. attrition

Documentation

Patient records include:

- description of appearance
- extent of supra and subgingival
- record color, type, extent, location
- patient care procedures

Summary

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.

Critical Thinking