DEPTH OF BIOLOGY

UNIT II **10 Hours**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.
- **Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

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Dental Products

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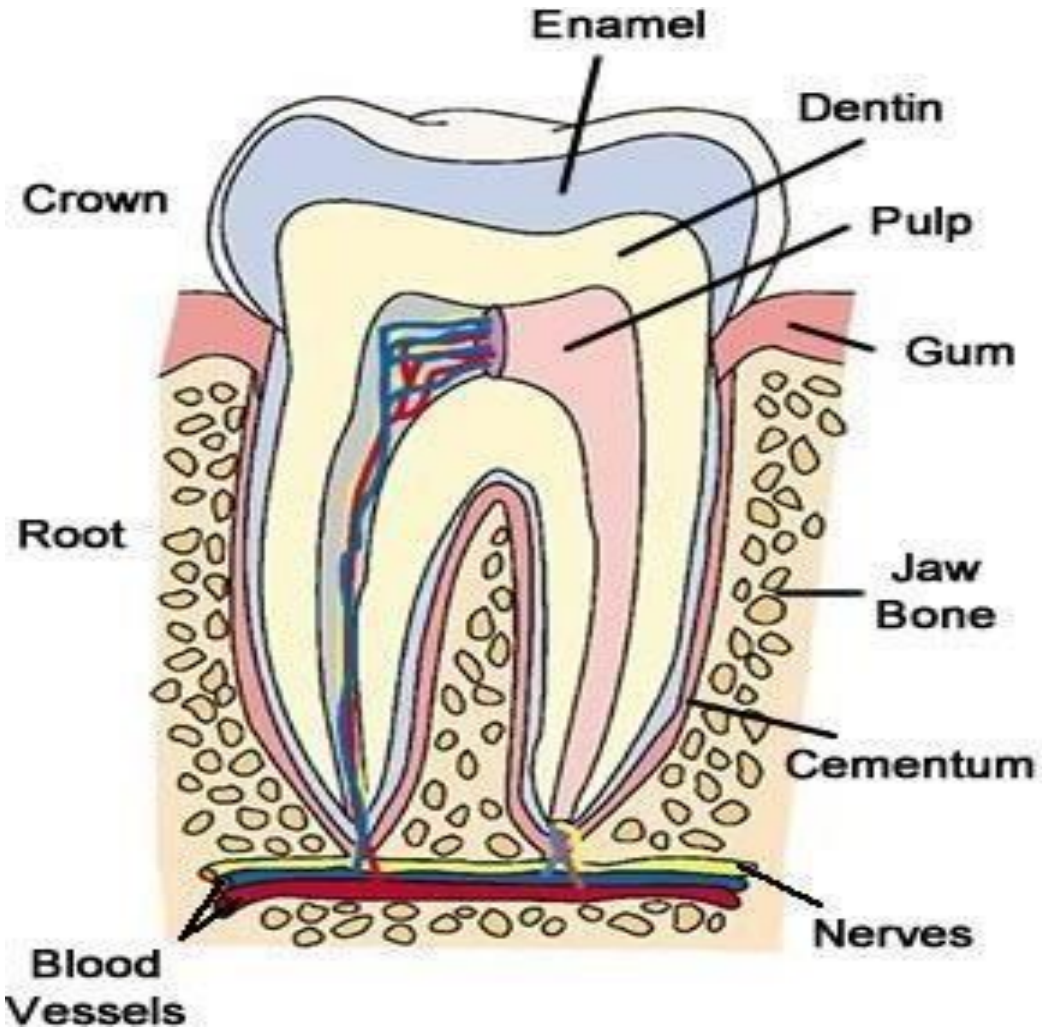
Dental Anatomy..... In Brief



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Common Dental Problems

- Dental Caries: formed by growth and implantation of cariogenic microorganisms.

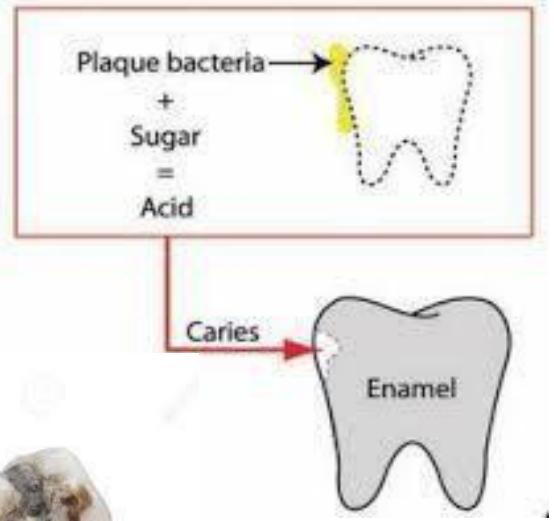
Causes:

- Bacteria – produce acids (lactic acid) that demineralize enamel &
- Food with high concentraiton of sugar.

Treatment: *Products with fluorides (NaF)*

& to alleviate the pain – Oral analgesics

e.g., *Acetaminophen*



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- Plaque and Calculus:

-Plaque: sticky substance formed by the attachment of bacteria to the pellicle which is this, cellular glycoprotein.

-Calculus: Calcium salts ppt from saliva & it formes when plaque is not treated within 24 hr.

Treatment:

- Soft, rounded, nylon bristles toothbrushes.
- *Dentifrices*: Toothpastes (Na bicarbonate, Ca carbonate, Dicalcium phosphate & Fluoride)
- *Desensitizing agents*: with 5% potassium nitrate compounds used to reduce the sensitivity of teeth to hot/heat & cold

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Gingivitis:

- Inflammation of gingiva caused by microoganisims.

Treatment: eugenol or benzocaine (anesthetics), Mouthwahes, Acetaminophen (Paracetamol)

Lesions:

- Occur on nonkeratinized mucosal surface in mouth
- Treatment: 7 – 14 days – heal,

Protectants, local anesthetics,

wound-cleansing agents

DENTAL PRODUCTS

- Products used to treat/prevent various common dental problems.
- Classification:

1. **Anticaries Agents:** Fluorides, Sodium Flouride (NaF)
2. **Dentifrices:** Fluorides, Desensitizing agents, Calcium carbonate

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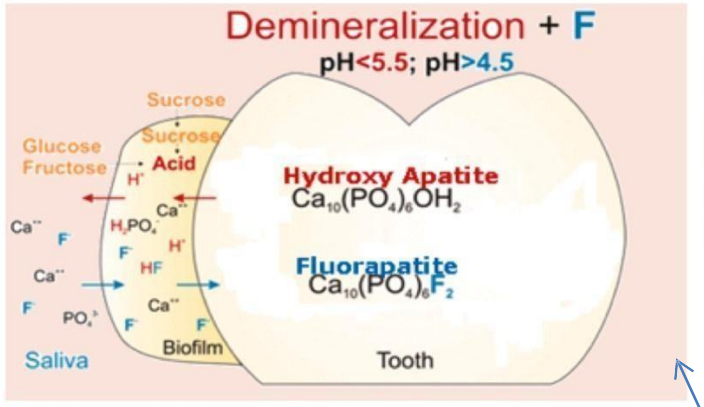
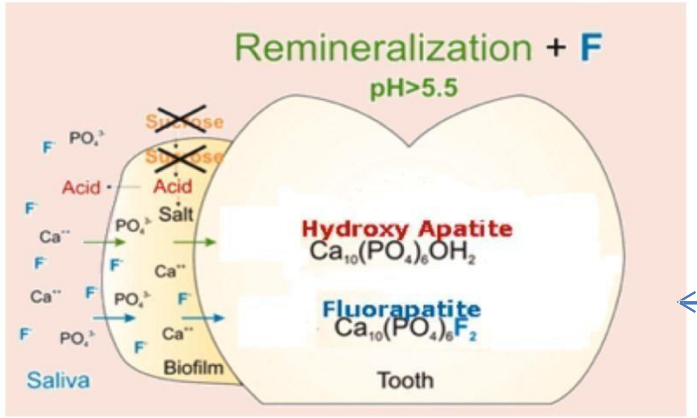
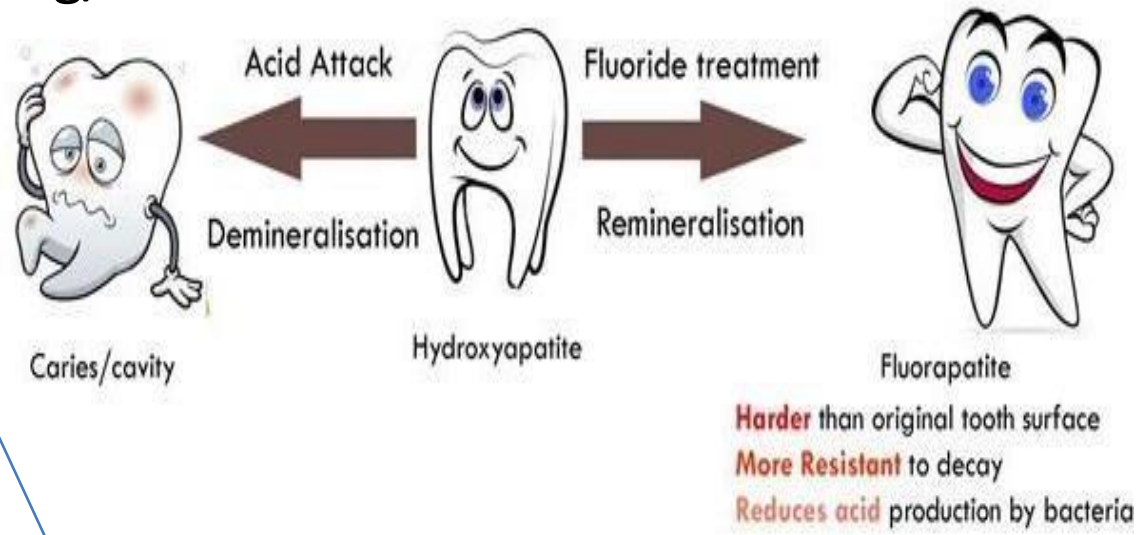
Fluorides

- Agent used to prevent the tooth decay (caries) – it get deposited on teeth.
- It is toxic in 5 – 10mg/kg. Acute toxicity causes nausea, vomiting and diarrhea. (Max. Conc. in toothpaste is 250mg/container.







Top – When sugar is present, acid gets produced, pH drops, and minerals leave the tooth surface Bottom – When sugar is not present, acid doesn't get produced pH rises and minerals enter the tooth surface.

Role of Fluoride

- Role of fluoride in preventing dental caries is well accepted.
- Administration of traces of fluoride having salts or their use topically to the teeth have reported encouraging results
- Fluoride ion is a trace element which occurs in the body.

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- Water fluoridation as well as topical fluoride applications (e.g. fluoridated toothpaste) appears to prevent caries.
- Topical fluoride sustains the fluoride levels in the oral cavity and helps to prevent caries, with reduced systemic availability.
- Fluoride can affect both the inorganic tooth structure & the bacterial metabolism in plaque, several

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- Administration: Oral (Fluoridation of public water (0.5 to 1 ppm)) & Topical.
  E.g., Sodium Fluoride (NaF)

NaF

Properties

Physical properties:

- White powder or colourless crystals
- Soluble in water, insoluble in alcohol

Chemical properties:

- hydrofluoric acid is produced upon addition of mineral acid.

$$NaF + HCl \longrightarrow HF + NaCl$$

Preparation:

a. Neutralizing hydrofluoric acid with sod. carbonate

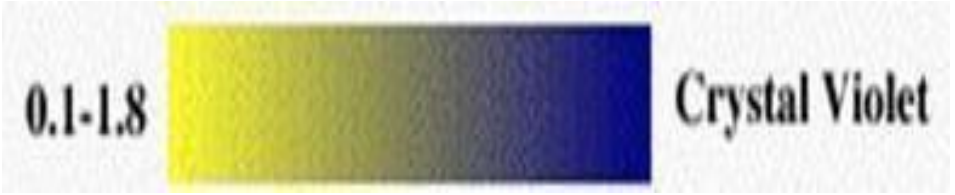
$$2\,HF + Na_2CO_3 \longrightarrow 2\,NaF + H_2O + CO_2$$

b. Double decomposition of calcium fluoride with sodium carbonate

$$CaF_2 + Na_2CO_3 \longrightarrow 2\,NaF + CaCO_3\downarrow$$

Assay:

- Principle: Non-aqueous titration
- Indicator : crystal violate
- Using perchloric acid $HClO_4$

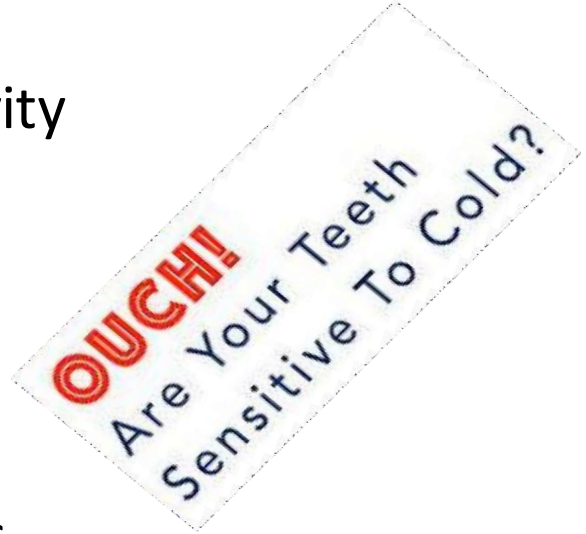


DENTIFRICES

It is a material used to clean the accessible surface of the teeth using preferably a tooth brush.

- Formulation
  - pastes, powders, slurries etc
- Content
  - Phosphate salts
  - Calcium carbonate
  - Mg carbonate
  - Aluminium oxide
  - Silicates
  - Foaming agents
  - Flavoring agents

Desensitizing Agents



- Agents those used in dental preparation to reduce sensitivity of teeth to heat and cold.
- Teeth are sensitive to heat and cold
- On the site of tooth decay there is strong sensitivity of toothache of heat and cold.
- Desensitizing agents reduce sensitivity may be by acting as local anesthetic.

Examples :-

- Pumice – It is complex silicates of aluminium, K and Na.
- Zinc chloride ($ZnCl_2$)
- Calcium Carbonate ($CaCO_3$)

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CALCIUM CARBONATE

$CaCO_3$

Synonym: Calc carb, Precipitated chalk

Physical properties:

- white, odourless, tasteless, very light powder
- Very slightly soluble in water

Physical properties:

- Calcium carbonate becomes soluble in presence of CO_2 and ammonium salts

$$CaCO_3 + \underbrace{H_2CO_3}_{H_2O + CO_2} \longrightarrow Ca(HCO_3)_2$$

$$CaCO_3 + 2NH_4 \longrightarrow Ca^{++} + 2NH_4 + H_2O + CO_2$$

CALCIUM CARBONATE $CaCO_3$

- It neutralizes acids,

$$CaCO_3 + 2\,HCl \longrightarrow CaCl_2 + H_2O + CO_2$$

Preparation:

a. From calcium chloride

- Adding boiling soln. of Sod. Carbonate to calcium chloride
- Ppt of calcium carbonate are washed and purified

$$Na_2CO_3 + CaCl_2 \longrightarrow NaCl + CaCO_3\ ppt$$

b. From lime water

- Passing CO_2 through lime water

$$CO_2 + Ca(OH)_2 \longrightarrow H_2O + CaCO_3\ ppt$$

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CALCIUM CARBONATE $CaCO_3$

Assay:

- Principle: Complexometric titration
- Sample is dissolved in aq. dil. HCl solution
- Boil to remove formed CO_2
- Titrated with std. disodium edetate
- Indicator: Calcon mixture

Use:

- non-systemic antacid
- Dentrifrices
- Pharmaceutical aid

Storage:

- Well closed containers

Sodium Fluoride (NaF)

Method of preparation

By passing hydrogen fluoride into solution of sodium carbonate.

$$Na_2CO_3 + 2HF \longrightarrow 2NaF + CO_2 + H_2O$$

Physical properties

1. Colorless powder
2. Odourless
3. Salty taste
4. Soluble in water
5. Insoluble in alcohol

Sodium Fluoride (NaF)

Uses

1. Anticaries agent
2. Prophylaxis of dental caries
3. Manufacturing of dental products
4. Used for preparation of insecticides and rodenticides

Storage

“ It should be stored in well closed container at a cool place. “

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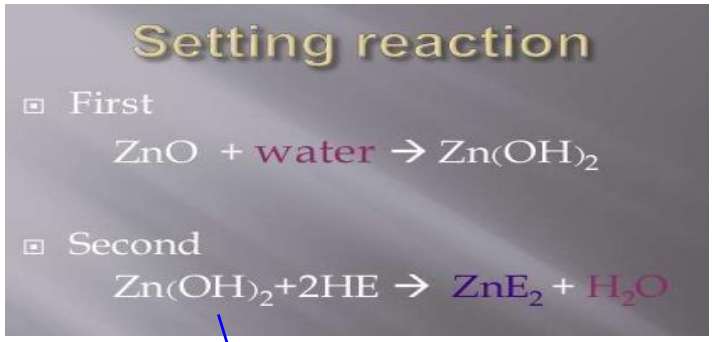
ZINC EUGENOL CEMENT

- ZINC OXIDE EUGENOL CEMENT (Zinc eugenolate)
- Introduced in 1858, is used as a Protective, sedative lining in deep carious cavities for
- Temporary Filling
- Temporary Cementing
- Pulp capping
- Root canal filling
- Surgical packing
- Available in powder & liquid form



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Top 5 Tips to Keeping Your Teeth Healthy

Visit your dentist every 6 months without fail

Brush your teeth at least twice a day

Remember to Floss!

Limit the amount of artificial sugar in your diet

Cut down on your drinking and stop smoking

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End of Unit II