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Chemical plaque control agents: They have proven to be an ideal adjunct to mechanical plaque control. They are designed to be used as supplements to mechanical plaque control procedures and not to replace them. They have ability to interfere with metabolic activity or adhesion of dental plaque.

Ideal properties of chemical plaque control agents:

- Should reduce plaque and gingivitis.
- Should prevent growth of pathogenic bacteria.
- Should prevent resistant bacteria.
- Should compatible with the oral tissues.
- Should not stain teeth or alter taste.
- Should exhibit good retentive properties.
- Should be inexpensive and easy to use.

Modes of action

1. Inhibition of bacterial colonization by interference with bacterial adsorption.
2. Inhibition of bacterial growth and metabolism (bactericidal and bacteriostatic effects).
3. Disruption of mature plaque by eliminating of existing plaque.
4. Modification of plaque biochemistry and ecology.

Chemoprophylactic agents are delivered as:

- Mouth rinses
- Dentifrices
- Gels (contains humectant, but without abrasives and foam agents).
- Sustained release devices and varnishes
- Chewing gums and lozenges (they increase the time of clearance of agents from the mouth).

The most widely used agents are:

Chlorhexidine (CHX): This antiseptic agent has both bactericidal and bacteriostatic activity depending on its concentration. Chlorhexidine is a cationic compound that binds to the hydroxyapatite of tooth enamel, the pellicle, plaque bacteria, the extracellular polysaccharide of the plaque, and especially to the mucous membrane. The chlorhexidine adsorbed to the hydroxyapatite is believed to inhibit bacterial colonization and prevent pellicle formation. Chlorhexidine may also inhibit the enzyme glucosyltransferase, which is essential for microbial accumulation on tooth surfaces, and the metabolic enzyme phosphoenolpyruvate phosphotransferase, which is involved in the transport and phosphorylation of glucose across the membrane. After binding, the agent is slowly released in an active form over 8 to 12 hours. Also, CHX is effective against gram +ve and yeast organisms. Tooth paste should be used before rinsing with chlorhexidine. Two daily rinses with 10 ml of 0.2% solution of chlorhexidine gluconate will completely inhibited the development of dental plaque, calculus and gingival inflammation. It can be used in concentration of 0.12% in 15 ml twice daily. Unpleasant taste and brown discoloration of teeth and filling are the side effects related to CHX.

Triclosan: It is phenol derivative included in mouthwashes and toothpaste. It has a broad spectrum of activity against gram positive, negative bacteria and yeasts. Dentifrice products containing a zinc citrate and triclosan combination have shown to be effective in reducing acid production and plaque formation and in preventing gingivitis.

Essential oil mouthwashes or Listerine: They are effective in controlling plaque and gingivitis because the oil alters the bacterial cell wall. The active ingredients (essential oils) used in these mouth rinses include a combination of thymol, menthol, eucalyptol, and methyl salicylate.

Enzymes: Certain enzymes are bactericidal to microorganisms. They would be able to breakdown already formed matrix of plaque and calculus. Enzymes like Mutanase and amyloglucosidase.

Sanguinarine extracts (SE): It is a herbal preparation obtained from the blood root of *Sanguinaria canadensis* plant. They are effective against Gram-positive and Gram-negative microorganisms, including oral microorganisms. SE may increase saliva-mediated aggregation. SE seems to exert a bactericidal effect by interfering with essential steps in the synthesis of the microbial cell wall.

Metal ions: Salts of zinc and copper are the most commonly used. These are effective plaque inhibitors at high concentration. Metallic salts reduce the glycolytic activity in microorganisms and delay bacterial growth. They have unpleasant taste with dry mouth and staining.

Antibiotics: Vancomycin, erythromycin and kanamycin have been used as agents for plaque control.

Dentifrices: They are substance used with toothbrush for purpose of cleaning the accessible surfaces of teeth. They may contain the followings:

- The therapeutic agent like fluoride to inhibit dental caries.
- Antimicrobial agent such as chlorhexidine to reduce microorganisms.
- An anti-calculus agent as zinc chloride or citrate to dissolve calculus.

The function of toothpaste in conjunction with toothbrush is:

- Minimizing plaque buildup.
- Anti-caries action.
- Removal of stains.
- Mouth fresher.

Composition of dentifrices: A dentifrice contains a number of ingredients that serve a definite purpose in providing adequate plaque control thus preventing caries and periodontal disease. The following are the common ingredients:

- Abrasive agents (Calcium carbonate, silicas): These agents have a mild abrasive action which aids in eliminating plaque and remove stained pellicle from tooth

surface. The degree of dentifrice abrasiveness depends on the inherent hardness of the abrasive, size of the abrasive particle, and the shape of the particle. The most common types of abrasives used are carbonates, phosphates, and silicas. Carbonates include calcium carbonate (chalk) and sodium carbonate (baking soda). Calcium carbonate is highly effective abrasive, although the calcium ion limits the amount of soluble fluoride in toothpaste up to 7 ppm. Phosphate abrasives include calcium pyrophosphate and dicalcium phosphate dihydrate. Silicas, such as silicon oxides, mechanically cleanse the tooth, are chemically inert, and do not react with other dentifrice ingredients.

- Binding agents (Water soluble agents): These agents control stability and consistency of toothpaste and effects ease of dispersion of the paste in the mouth.
- Detergents: They are producing the foam which aid in the removal of food debris and also dispersion of the paste in the mouth. Sodium lauryl sulfate is the most widely used detergent. It is stable, possesses some antibacterial properties, and has a low surface tension, which facilitates the flow of the dentifrice over the teeth. Sodium lauryl sulfate is active at a neutral pH, has a flavor that is easy to mask.
- Humectants (Glycerin, mannitol, glycerol): These agents aid in reducing the loss of moisture from the toothpaste and prevent hardening. These humectants are non-toxic, but bacterial growth can occur in their presence. At high concentration (>40%), humectants act as preservatives.
- Flavoring agents (Peppermint oil): They render the product pleasant to use and leave a fresh taste in the mouth after use.
- Anti-calculus agents (soluble pyrophosphates or zinc citrate): These agents are designed to inhibit the mineralization of plaque. Dentifrices containing these agents are labeled as tartar control toothpastes.

- Sweeteners and coloring agents (Sorbitol, mannitol): They serve a dual role as sweetening agents and humectants. Glycerin also serves as a humectant, adds to the sweet taste. A new sweetener in some dentifrices is xylitol.
- Anti-caries agents (NaF, MFP, SnF₂): These agents aid in the control of caries.
- Essential-oil dentifrices, Listerine as anti-halitosis.
- Desensitizing agents: Potassium nitrate is a commonly used, it reduces the reaction of nerves in the teeth to stimuli such as heat and cold. It is known to desensitize the nerve by penetrating through the length of the dentinal tubules and to depolarize sensory nerve endings located at the dentin–pulpal interface.
- Whiteners (hydrogen peroxide or carbamide peroxide): The dentifrices (contain whiteners) control stain via physical methods (abrasives) and chemical mechanisms (surface active agents or bleaching/oxidizing agents). Carbamide peroxide breaks down to form urea and hydrogen peroxide. Hydrogen peroxide, in turn, forms a free radical that contains oxygen, which is the active bleaching molecule. Papain, a naturally occurring enzyme that destroys protein is rapidly diluted by saliva. Home-bleaching products can contain other chemicals to aid in the delivery of the bleaching agent. Glycerin or propylene glycol is commonly added to thicken the solution and prolong contact with the tooth surface.
- Baking soda dentifrices: Baking soda (sodium bicarbonate) had a long history of use as an oral-hygiene aid. They are known to reduce plaque and gingivitis, remove extrinsic stain, and reduce malodor. Baking soda dentifrices actually contain only a small amount of baking soda in addition to the standard fluoride compatible abrasives.