Chemical Plaque Control

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Bacteria present in oral biofilms are responsible for the most prevalent diseases of mankind: caries and periodontal diseases. Therefore, control of oral biofilms becomes essential for the prevention of those diseases.

Categories of formulations

Formulations for chemical plaque control can be classified according to their effects (Lang & Newman 1997):

- **Anti- adhesive:**
  They would act at the pellicle surface to prevent the initial attachment of the primary plaque forming bacteria and development of biofilms (e.g. delmopinol)

- **Anti-microbial:**
  They could inhibit plaque formation through one of two mechanisms alone or combined.
  Bacteriostatic effect: The first would be the inhibition of bacterial proliferation therefore could exert their effects either at the pellicle coated tooth surface before the primary plaque formation bacteria attach or after attachment but before division of these bacteria.
  Bactericidal effect: The second effect where the antimicrobial agents destroys all of the microorganisms either attaching or already attached to the tooth surface.

- **Plaque removal agents:**
  Such agents contained in a mouth rinse to reach all tooth surfaces and act in identical manner to a tooth brush and remove bacteria from the tooth surfaces have attracted the terminology of the chemical tooth brush e.g. Hypochlorites.

- **Anti-pathologic:**
  These agent might inhibit the expression of plaque microorganism pathogenicity without necessarily destroying them and directly approaches to alter plaque ecology to a less pathogenic flora, e.g. antimicrobial agents in the bacteriostatic effect.

Vehicles for delivery of chemical agents:

- Tooth paste
- Mouth rinse
- Sprays
- Irrigators
- Chewing gum varnishes
- Gels and chips

These agents should have persistent action (substantivity) measured in hours which depend on:

1. Adsorption and prolonged retention on oral surface including pellicle coated teeth.
2. Maintenance of antimicrobial activity once absorbed
3. Slow release from oral tissue.

Chemical Plaque Control Agents

- Antibiotics
- Enzymes
- Amine alcohols
- Detergents
- Oxygenating agents
- Metal salts
- fluorides
- Natural productsEssential oils
- Triclosan
- Bisbiguanides
- Quaternary ammonium compounds
- Hexetidine
- Povidone iodine

- **Enzymes**
  - ❑ Disrupt the biofilm.
    - Dextranase, mutanase, proteases, and lipases.
    - Very limited substantivity and frequent side effects.
  - ❑ Enhance the host defenses
    - Glucose oxidase and amyloglucosidase.
    - Marketed as Zendium.

- **Amine alcohols**
  - Delmopinol and octapinol.
  - Mechanism of action by the inhibition of biofilm matrix formation or disruption of the biofilm matrix.
  - Delmopinol has been formulated and clinically evaluated as a mouth rinse at 0.1% and 0.2%.
  - *Limitations*. Most relevant side effects are dental staining, a temporary feeling of numbness in the

  mucosa (e.g. tongue), and a burning sensation.

- **Detergents**
  - sodium lauryl sulfate (SLS).
  - Substantively of 5–7 hours.
  - The foaming properties of detergents may help in removing plaque.
  - SLS is present in many dentifrice and mouth rinse formulations

- **Metal salts**
  - Zinc salts (Zinc lactate, zinc citrate, zinc sulfate, and zinc chloride).
  - As sole agents they have limited effects on plaque, but if combined with other active agents, there is an improvement in substantivity and action.
  - Combination products have been evaluated for plaque control (zinc lactate with CHX; zinc citrate with triclosan).

- **Oxygenating agents**
  - Sodium peroxyborate and peroxycarbonate, and hydrogen peroxide.
  - Characteristics. Exert antimicrobial effects through the release of oxygen
  - Hydrogen peroxide-Supragingival plaque control.
  - Peroxycarbonate-Acute ulcerative gingivitis.

- **Fluoride**
  - Sodium fluoride and sodium monofluorophosphate.
  - Usefulness has been demonstrated in reducing caries incidence.
  - Fluoride ion has not demonstrated plaque-inhibitory or antiplaque properties

- **Natural products**
  - Sanguinarine is an alkaloid obtained from the plant Sanguinaria canadensis.
  - Clinical evaluation reported that sanguinarine extract with zinc chloride, as dentifrice, as mouth rinse or the combined use .Significant reductions in terms of plaque and gingivitis were reported with combined use
  - Limitations: Use of formulations of sanguinarine was associated with oral leukoplakia.

- **Essential oils**
  - Mechanism of action: cell wall disruption, inhibition of bacterial enzymes, extraction of endotoxins derived from lipopolysaccharide (LPS) of Gram negative Bacteria and anti-inflammatory action based on antioxidant activity
  - A mouth rinse with essential oils has demonstrated antimicrobial activity and plaque inhibitory and antiplaque effects.
  - Marketed. There are different formulations of Listerine

- **Triclosan**
  - Formulated both in mouth rinses and in dentifrices.
  - In mouth rinses, at 0.2%, there is a limited bactericidal activity and a substantivity of approximately 5 hours.
  - As a dentifrice, it can be detected for up to 8 hours in dental plaque following application
  - Combination with zinc citrate or pyrophosphate, in order to improve the substantively and/or the antimicrobial activity.

- **Quaternary ammonium compounds**
  - Benzylconium chloride and cetylpyridinium chloride (CPC)
  - Characteristics. Monocationic agents that rapidly adsorb to oral surfaces.
  - Substantivity approaches 3–5 hours, due to rapid desorption, loss of activity

- **Chlorhexidine digluconate**
  - Chlorhexidine is a cationic bisbiguanide that has been used as a broad-spectrum antiseptic.
  - 0.2% concentration of chlorhexidine has been used as a preventive and therapeutic agent.
  - Chlorhexidine is bacteriostatic or bactericidal, depending on the dose.
  - The American Dental Association (ADA) has approved chlorhexidine to help prevent and reduce supragingival plaque and gingivitis

Chlorhexidine Products

1. Mouth rinse.
2. Gel.
3. Sprays.
4. Dentifrices.
5. Varnishes.
6. Slow release vehicles.

Uses of CHX

1. As adjunct to oral hygiene and professional prophylaxis
2. Immediate preoperative rinsing and irrigation
3. Post oral surgery including periodontal surgery or root planning
4. In patients with jaw fixation.
5. For oral hygiene & gingival health in physically & mentally handicapped.
6. Medically compromised individuals predisposed to oral infections.
7. High-risk carries patient
8. Recurrent oral ulceration.
9. Removable & fixed orthodontic wearers.
10. Denture stomatitis.

CHX Side Effects

1. Taste perturbation where the salt taste is preferentially affected to leave the food and drinks with a rather bland taste.
2. Brown discoloration of the teeth and some restorative materials and the dorsum of the tongue.
3. Unilateral or bilateral parotid swelling.
4. Enhanced supragingival calculus formation
5. Oral mucosal erosion appears to be concentration dependent.
6. CHX also has a bitter taste which is difficult to mask completely.

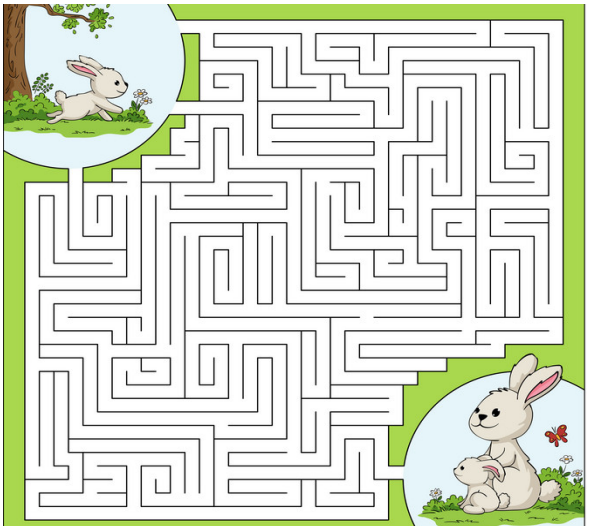
Frequency

- Twice daily oral rinsing for 30 second in the morning and evening after 30 minutes of tooth brushing.

Instruction

- Do not rinse with water or other mouthwashes, brush teeth and eat immediately after using CHX mouthwash.
- With tooth brushing by using tooth paste, CHX mouth wash should be used after 30 minute of brushing otherwise cross reaction may occur and reduce the plaque inhibition of CHX.
- Studies suggest a slow release of CHX from surface to produce a persistent bacteriostatic action lasting for about 12 hours that's why it is should be used twice a day.

MAZE
Help the bunny find the way?



The future is an ever-shifting maze of possibilities until it becomes the present