



▶ 1. DISPOSABLE TOOTHBRUSH:

- A Disposable toothbrush is usually a small, inexpensive oral hygiene tool, most often used only once before its disposal.
- Usually, it comes with toothpaste on a toothbrush which is ideal for use during short trips.

2. CHEWABLE TOOTHBRUSH:

A Chewable Toothbrush is a miniature plastic moulded toothbrush requiring no toothpaste or water.

It is simply chewed and rolled around the mouth and is disposed off after use.

A chewable toothbrush contains xylitol, flavoring aqua, and polydextrose





It means the loss of tooth substance produced by mechanical wear other than by mastication.

The contributing factors are:

- hard toothbrush,
- horizontal brushing,
- abrasive agents in dentifrice,
- excessive pressure during brushing and prominence of the tooth surface labially or buccally.
- The abraded areas are on the cervical areas of exposed root but may occur on enamel.

Corrective measures:

Recommend

- a less abrasive dentifrice,
- change the tooth brush method
- and advise the patient to use soft texture bristles.

Interdental Cleaning aids:

- The toothbrush does not completely remove interdental plaque either in healthy or periodontal involved patients.
- Interdental cleaning is crucial to augment the effect of tooth brushing.



<section-header> Factors affecting the selection of interdental cleaning aids: Type of gingival embrasures. Alignment of teeth. Fixed prosthesis or orthodontic appliances. Open furcation areas. Contact areas.

Dental floss

- It is used to remove plaque from interproximal surfaces in which the embrasure is completely occupied by healthy interdental papilla.
- There are many types either waxed, unwaxed, flavored or tape

Function of dental floss:

- 1. Remove of adherent plaque and food debris to teeth and others.
- > 2. Reducing gingival bleeding.
- ▶ 3. Improving oral hygiene.
- ▶ 4. Massaging the interdental papillae.
- 5. Helping in locating calculus, overhanging restorations and proximal carious lesion.
- ▶ 6. Polishing of tooth surfaces during plaque removal

DENTAL FLOSS







Tongue brushing:

The tongue is anatomically perfect for harboring bacteria.

The tongue can transmit organisms during toothbrushing and infection or reinfection of a periodontal pocket.

For these reasons, the tongue, especially those with fissuring or prominent papilla, should be regularly cleaned.

Commercial tongue cleaners, made of plastic or a flexible metal, are also available.

They are curved so they can be placed over the tongue without touching the teeth. These instruments are swept over the dorsum of the tongue to remove bacterial plaque and debris



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.





- 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.





Chemical plaque control agents

L.KHAWLA M. SALEH PREVENTIVE DENTISTRY

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 salicylat

disadvantages

- Although the safety of essential oils is well established,
- some patients can have difficulty tolerating the burning sensation associated with the alcohol content.
- In addition, slight extrinsic staining has been reported with the use of essential oils rinses

- Essential oil mouthrinses are indicated for patients who need and are compliant with antiplaque/antigingivitis mouthrinses
- Patients are advised to rinse twice daily with one-half ounce of Listerine for 30 seconds in addition to their usual oral-hygiene regimen.
- Microorganisms do not develop a resistance to the antibacterial effects of essential oils, such as clove oil (eugenol) and thyme oil (thymol). As with chlorhexidine,

As with chlorhexidine, just rinsing with an essential oil mouthrinse is unlikely to be effective in treating periodontitis because the solution does not reach the depths of the periodontal pockets



- For the dental professional, these mouthrinses are recommended in patients prior to aerosol- generating procedures.
- Unless the dental professional uses an effective dry-field technique in a 30-second period,
- the bacterial aerosol generated by an ultrasonic scaler that removes calculus, an air- powered tooth polisher, or a slow-speed or high-speed hand piece can be roughly equivalent to the aerosols received from a patient directly sneezing into the dental provider's face.

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:
- 1. The therapeutic agent like fluoride to inhibit dental caries.
- 2. Antimicrobial agent such as chlorhexidine to reduce microorganisms.
- 3. 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.



Recent developments in dentifrices

- Tooth paste for children
- Natural tooth paste (herbal)
- · Whitening tooth paste
- · Breath freshening tooth paste
- · Sodium bicarbonate tooth paste

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.
- 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
- 1. the inherent hardness of the abrasive,
- 2. size of the abrasive particle,
- 3. and the shape of the particle.



- ▶ The most common types of abrasives used are:
- carbonates, phosphates, and silicas.

1.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.

2. Phosphate abrasives include calcium pyrophosphate and dicalcium phosphate dihydrate.

3. Silicas, such as silicon oxides, mechanically cleanse the tooth, are chemically inert, and do not react with other dentifrice ingredients.

- When toothbrush abrasion damage does occur,
- it usually appears as a V-shaped notch in the cementum apical to the cementoenamel junction.
- This area is vulnerable because enamel is about 20 times harder than dentin or cementum.

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.

For this reason, preservatives such as sodium benzoate, dichlorinated phenols, and alcohols are added to prevent their growth.

At high concentration (>40%), humectants act as preservatives

Flavoring agents

- They render the product pleasant to use and leave a fresh taste in the mouth after use.
- Spearmint, peppermint, wintergreen, cinnamon, and the most recently introduced flavor, vanilla give toothpaste a pleasant taste, aroma, and refreshing aftertaste.
- It is difficult to formulate a flavor that is universally acceptable because people have different color and taste preferences.
- Some manufacturers use essential oils such as thymol which can provide a "medicinal" taste to the product.

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.



- 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





• Caries is not the consequence of a single event (as is a classical infectious disease for example)

• but it is rather a sequel of a series of processes happening over a longer period of time.

- Assessment of the individual patient's current caries activity and risk of future caries progression is an important part of recent dental practice.
- The dentist always must remember that treat patients not just individual lesions

RISK FACTOR:

• : an environmental, behavioral, or biologic factor usually confirmed by temporal sequence in longitudinal studies, which if present, directly increases the probability of a disease occurring, and if absent or removed reduces the probability

Important biological and environmental risk factors include:

- 1. salivary flow
- 2. level of oral hygiene
- 3. some dietary aspects
- 4. fluoride exposure



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2. Dental history.

Current activity state of caries lesions.

- Past history of caries.
- Current oral hygiene practices and proficiency.
- Current exposure to topical fluorides from toothpastes rinses or tablets.
- Current dietary pattern

GOALS OF CARIES RISKS ASSESSMENT

Screen out low risk patients (to allow safe recommendation of long recall intervals).

- Identify high risk patients before they become caries-active.
- Monitor changes in disease status in caries-active patients.







CARIES RISK FACTORS

The best indicators for increased risk of dental caries are:

- 1. Medium or high *mutans streptococcus* and *lactobacillus* counts.
- 2. Visible heavy plaque on teeth: This indicates poor oral hygiene.
- 3. Inadequate exposure to fluoride.
- 4. Frequent (>three times daily) snacking between meals.
- 5. Deep pits and fissures.
- 6. Low socioeconomic status.

RISK FACTORS OF TOOTH DECAY





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- 7. Inadequate salivary flow by observation or measurement: Saliva reducing factors
 - (medications/radiation/systemic)
- 8. Orthodontic appliances: The presence of fixed or removable appliances in the mouth such as orthodontic brackets or removable partial dentures leads to undue accumulation of plaque and an increase in the percent of cariogenic bacteria.
- 9. Exposed roots.
- 10. Any physical or mental illness and any oral application or restoration that compromises the maintenance of optimal oral health.



- . The protective factors are:
- 1. Lives/work/school located in a fluoridated community.
- 2. Fluoridated toothpaste (1500 ppm fluoride) at least two times daily.
- 3. Fluoridated mouth rinse (0.05 percent NaF) daily.
- 4. Fluoridated varnish during the last six months







- 6. Professional topical fluoride during the last six months.
- 7. Chlorhexidine used two times daily during the last six months.
- 8. Xylitol gum/lozenges four times daily during the last six months.
- 9. Adequate salivary flow.



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Caries susceptibility

It determines the susceptibility or resistance of a tooth to a caries enhancing environment.

The risk of developing a lesion, however, is individual and varies, depending on the tooth, its localization, surfaces, previous fluoride exposure etc.

Caries Activity

It is a measure of the speed of progression of a carious lesion. Retrospectively it can be determined as caries incidence, that is, new carious lesions over time of an individual or population.

CARIES-RISK

Generally speaking, risk is defined as the probability of incidence of an event within certain period of time.

The caries-risk, therefore, is the risk of an individual developing a carious lesion.

- **1.** Low caries risk.
- 2. Moderate caries-risk group.
- **3.** High caries-risk.



DETERMINATION OF CARIES-RISK IS IMPORTANT FOR:

- Assessment of the individual etiological factors of existing carious lesions and of the caries risk situation
- • Repeated determination of the caries-risk allows an evaluation of the success of, or the need for, modification of preventive measures
- Indications of an increased caries-risk in specific children in community preventive programs will allow selection of an individual preventive program in order to minimize the development of carious lesions



Caries risk assessment (2nd part)

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Factors in Low, Moderate and High Caries

▶<u>Low risk</u>

- ▶ No new or incipient carious lesions in the past years.
- .low caries in siblings
- ▶ . regular dental attendance .
- ▶ .No regular snacking
- ▶ .No problem medically .
- ▶ .No physical problem .
- ▶ .Normal flow of saliva
Low Risk.....Continue

- □ .No long term medication .
- □ .Infrequent intake of sugar .
- □ .Fluoridated area .
- □ .Fluoridated supplements
- □ .Fluoridated toothpaste .
- Frequent, effective cleaning Good manual tooth brushing.

- □ .Low counts of Sterp. Mutans Low counts of lactobacillus.
- □ .No or very few restorations.
- □ .No recurrent caries .
- □ .Fissure sealants Present .
- □ No orthodontic fixed or removable or fixed Prosthesis

Factors in Low, Moderate and High Caries In Children

Moderate risk (any of the following)

- One new, incipient or recurrent carious lesion in the past year.
- Deep pits and fissures.
- High caries experience in siblings.
- History of pit and fissure caries.
- Early childhood caries.
- Frequent sugar exposures.

Factors in Low, Moderate and High Caries In Children..... continue

Moderate risk (any of the following)

- Decreased salivary flow.
- Compromised oral hygiene.
- Irregular dental visits.
- Inadequate fluoride exposure.
- Proximal radiolucency.

Factors in Low, Moderate and High Caries

High risk

- Two or more new incipient or recurrent carious lesions in three or more carious lesions in the past
- Deep or non coalesced pits and fissures.
- Siblings or parents with high caries rate.
- History of pit and fissure caries.

High riskContinue

- Frequent sugar exposures.
- Decreased salivary flow.
- Compromised oral hygiene
- Irregular dental visits.
- Inadequate fluoride exposure.



Caries Risk in Children

- Early childhood caries Children in the age group 12-30 months have a special caries pattern that differs from older children.
- Caries affects the maxillary primary incisors first primary molars in a way that reflects the pattern of eruption.
- The longer the tooth has been present and exposed to the caries challenge, the more it will be affected.
- The upper incisors are most vulnerable, while the mandibular incisors are protected by the tongue and saliva from submandibular and sublingual glands.



Cariogram

- ▶ What is the meaning of Cariogram?
- Cariogram It is a new and interactive way to illustrate interactions between caries, or tooth cavity, related factors.
- It demonstrates the caries risk graphically and shows the risk for developing new caries in the future and also chances to avoid new caries in the near future.
- Cariogram is an interactive computer programme conceptualized by Dr. Bratthall in 1997.

Another definition of Cariogram

Cariogram is the only such model which can evaluate several factors such as host response, pathogens and cariogenicity of the diet involved in the development of caries and can give an individual interpretation of caries risk. The Cariogram, is a pie circle-diagram, divided into five sectors which include:

 The green sector shows an estimation of the 'Actual chance to avoid new cavities'.
 The green sector is 'what is left' when the other factors have taken their share.



- 2. The dark blue sector 'Diet' is based on a combination of diet contents and diet frequency.
- 3. The red sector 'Bacteria' is based on a combination of amount of plaque and mutans streptococci.
- 4. The light blue sector 'Susceptibility' is based on a combination of fluoride program, saliva secretion and saliva buffer capacity.
 5. The yellow sector 'Circumstances' is based on a combination of past caries experience and related diseases.

How do you read a Cariogram?

- ▶ The following five Cariogram categories were used:
- "very low risk" = 81-100% chance to avoid caries;
- "low risk" = 61-80% chance to avoid caries;
- "moderate risk" = 41-60% chance to avoid caries;
- "high risk" = 21-40% chance to avoid caries;
- "very high risk" = 0-20% chance to avoid caries.







Diagnosis of dental caries

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Dental caries

Tooth caries is chronic, progressive, and bacterial diseases.

(According to WHO)

Caries is defined as a localized post eruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity.

The main characters of tooth caries are the changes in color, shape, and quality of tooth hard tissue.

The typical pathological changes have important reference value for caries diagnosis.

At present, the methods for dental caries diagnosis are mainly based on clinical inspection and X-ray examination. However, it is difficult to identify early caries which is in the hidden area of the tooth.

Prevention is at its most effective when detection is early within the natural history of the dental caries.

The failure to detect early caries, the ability to monitor early lesions and determine if they have indeed arrested or stabilized is also key to ensuring that effective prevention can become commonplace in general dentistry.



Code Description Sound tooth : A crown is recorded as sound if it shows no evidence of **treated** or **untreated** dental caries.

Decayed crown Caries is recorded as present when a lesion in the pit and fissure or on a smooth tooth surface has an unmistakable cavity, undermined enamel, or a detectably softened floor or wall. Where any doubt exists, caries should not be recorded as present





Diagnosis is a decision process and is informed by, initially, detection of a lesion and should be followed by an assessment of the patient's caries risk, which may include the number of new and past caries lesions, diet, presence or absence of modifying factors (salivary flow, mutans streptococci counts, oral hygiene), and qualitative aspects of the disease such as color and anatomical location.

The assessment of lesion activity together with lesion detection is essential to arrive at the disease diagnosis and the appropriate clinical treatment decision.

Detection systems of caries

- 1. visual and tactile examinations
- 2. Radiographic techniques
- 3. Electrical current measurement (electronic resistant method)
- Fiber Optic Transillumination (FOTI and DiFOTI) (Enhanced visual techniques)
- 5. Fluorescent techniques
- 6. Other techniques like Dyes, Ultrasound techniques, Photo-thermal Radiometry.

Visual and tactile examination

- Visual inspection, the most widespread caries detection system, is subjective.
- Assessment of features such as color and texture are qualitative in nature. These assessments provide some information on the severity of the disease.
- They are also limited in their detection threshold, and their ability to detect early, non cavitated lesions restricted to enamel is poor



The PRIMARY OBJECTIVE of caries diagnosis is to identify those lesions that require restorative treatment, those that require non-surgical treatment, and those persons who are at high risk for developing carious lesions.

Some decades ago, visual diagnosis (light and mirror) and probing, supplemented by bitewing radiographs were the only tools available for clinical diagnosis of caries. For epidemiologic surveys and for examination of most patients, these are still useful tools.



 Detection of initial caries by sharp probe may lead to cavity formation which reducing the chance of remineralization of intact surfaces The traditional method of detecting caries signs is by visual inspection of dental surfaces, with the aid of a bright light and dental mirror if necessary to see teeth from all angles. Reflecting light onto the mouth mirror also can be done to search for dark shadows that could indicate dentin lesions.

While the use of a dental probe continues to be controversial, it is extremely helpful when used correctly .

A probe is unnecessary if visual inspection detects a cavity.



Visual methods:

- 1. Detection of white spot, discoloration / frank cavitations
- 2. Without aids, unreliable
- 3. Magnification loupes- Head worn prism loupes (X 4.5) or surgical microscopes(X 16) may be used *comfort, relatively inexpensive, available in various magnification*

4. Use of temporary elective tooth separation



- Good dryness is recommended while detection of initial lesion.
- A clinical caries examination performed according to these principles takes about 5- 10 min, depending on the caries status of the patient.
- Caries on proximal contact area is difficult to be examined by inspection and probing.
- Dental floss can be used as a convenient method



Benefits of visual and tactile examinations

- Is quick and easy to perform.
- Does not need expensive equipment.



Use of explorer is not advocated because

 Sharp tips physically damage small lesions with intact surfaces
 Probing can cause fracture & cavitation of incipient lesion. It may spread the organism in the mouth
 Mechanical binding may be due to noncarious reasons
 Shape of fissure
 Sharpness of explorer
 Force of application
 Path of explorer placement

Use of explorer

• Explorer is useful to remove plaque and debris and check the surface characteristics of suspected carious lesions.

• gentle pressure just required to blanch a fingernail without causing any pain or damage

• All surfaces of a tooth are cleaned of debris and plaque, using an air syringe and examined visually. Suspicious areas are explored to check for the surface texture.







SMOOTH SURFACE CARIES

Non-cavitated:

- No signs of cavitation after visual or tactile examination.
- Location: where dental plaque accumulates (gingival margin).
- Surface characteristics: Matted (not glossy) when a tooth is dried.

Non-cavitated carious lesions (enamel)



Cavitated Lesions:

Where there is visual breakdown of a tooth surface, it is classified as cavitated carious lesion. An active cavity on a smooth surface has soft walls or floors shown below:



Questionable Area:

All stained smooth coronal tooth surfaces that do not have the characteristics of non-cavitated or cavitated lesions are classified as questionable shown below



Non-Carious Enamel Opacities





Moderate dental fluorosis



Severe dental fluorosis

Pit and Fissure Caries Non-cavitated carious lesion

Enamel





White demineralization lines



 Non-cavitated carious lesion (dentin)

Dentin



If a discolored area is hard when gently explored then it should be marked as *questionable*.



Inactive root surface lesion (arrested):

- well-defined dark brown/ black discoloration
- smooth and shiny
- hard on probing with moderate pressure Active lesion





Nursing bottle caries Vs Specific form of rampant caries

Primary dentition affected C/F: specific pattern- maxillary incisor ®molars

Mandibular incisors not affected



Rampant caries Acute, widespread caries with early pulpal involvement of teeth that are usually immune to decay Both dentitions affected



Rapid appearance of new lesions Mandibular incisors also affected

RADIOGRAPHY

Radiographic examination (traditional and digital) can be helpful in locating proximal caries and undermining caries and secondary caries.

They are valuable On average they have around 50% to 70% sensitivity in detecting carious lesions. 40% demineralization is required for definitive decision on caries

- Periapical and bite-wing radiographs are commonly used for clinical assessment of caries.
- bite-wing radiographs raise the sensitivity of the diagnosis if obvious dentin caries activity to be detected but can be inaccurate if diagnosing enamel occlusal caries activity.
- Radiolucency on hard tissue due to demineralization is identified as carious lesion

Radiographic examinations include; Bitewing radiographs Dental panoramic tomograph

The two important decisions related to
radiographic examination are
(1) when to take a radiograph
(2) how to evaluate a radiograph for presence of signs of dental caries.

PIT & FISSURE CARIES

Incipient occlusal lesions: Not very effective. Caries starts on the walls of the pits & fissures and tends to spread perpendicular to the DEJ Only detectable change is a fine gray shadow at the DEJ.



Moderate occlusal lesions:

Moderate occlusal lesions: First to induce specific changes helping in a definitive diagnosis Broad based, thin radiolucent zone in dentin with minimal or no changes in enamel Presence of a band of increased opacity between the lesion and the pulp chamber due to

calcification within primary dentin

This feature is not seen in buccal caries



Severe occlusal lesions:

Readily observed both clinically and radiographically Appear as large cavities in the crowns of the teeth However pulp exposure cannot be determined









- Miss diagnosis by radiograph can occur as a result of superimposition, angulation of cone, difficulty of film position.
- The intervals between bitewing examinations should be based on individual risk assessment.



Annual examinations should be considered in the following situations:

- age 5–7: one or more approximal dentin lesion or several approximal enamel lesions in primary molars
- age 7–12 (mixed dentition): a permanent first molar with approximal caries, half through the enamel or several approximal lesions in primary molars
- age 12–13: one or more approximal dentin lesion or restored approximal surface three or more approximal enamel lesions any unrestored approximal dentin lesion a recently restored approximal neighboring surface.
- The degree of caries risk should be reassessed individually by considering the number of new lesions, and progression of existing lesions, as well as other relevant risk factors.
 The interval to the next bitewing examination is adjusted accordingly. Intervals shorter than 1 year are seldom indicated
 - . A 6-month interval is, however, advocated if several approximal dentin lesions are left unrestored. This applies to children and young adults.





DIGITAL IMAGING

A digital image is an image formed & represented by a spatially distributed set of discrete sensors & pixels

2 types of non- film receptors

Direct digital imaging – digital image receptor

Indirect digital imaging – video camera for forming





Digital radiography

- Digital radiography has offered the potential to increase the diagnostic yield of dental radiographs,
- it also offers a decrease in radiographic dose and thus offer additional benefits than diagnostic yield.
- Digital images can also be archived and replicated with ease. Using digital radiographs offers a number of opportunities for image enhancement, processing, and manipulation.

Advantages:

- 1.Images are available in seconds
- 2. Exposure is reduced 50-90%
- 3. Image size, contrast and density can be manipulated to improve interpretation
- 4. Record keeping is vastly improved.
- All films are labeled, filed and retrieved easily.
- Duplicate hard copies are the same as originals and simple to make
- 5. Provision of tele transmission

Electrical current measurement

 Caries can be described as a process resulting in an increase in porosity of the tissue, enamel or dentine. This increased porosity results in a higher fluid content than sound tissue, and this difference can be detected by electrical measurement by decreased electrical resistance or impedance





- A number of physical factors also will affect ECM include:
- Porosity
- the temperature of the tooth,
- the thickness of the tissue,
- the hydration of the material,
- and the surface area.
- Concentration of ions in the dental tissue
- A major advantage of ECM is to present objective readings which have the potential for monitoring lesion progression, arrest, or remineralization.

Fiber-optic transillumination

Fiber-optic transillumination FOTI as a caries detection technique is based on the fact that carious enamel has a lower index of light transmission than sound enamel.

The light is absorbed more when the demineralization process disrupts the crystalline structure of enamel and dentin. In essence this gives that area a more darkened appearance.

This method of caries detection uses a light source, preferably bright, to illuminate the tooth.

Caries or demineralised areas in dentin or enamel show up as darkened areas with this technique.



Posterior approximal caries can be diagnosed with the light probe positioned on the gingivae below the cervical margin of the tooth, whereby the light passes through the tooth structures and approximal decay produces a dark shadow on the occlusal surface.



- Normal, visible light, this appears as a 'whiter' area called white spot.
- This appearance is enhanced if the lesion is dried; the water is removed from the porous lesion.
- Water has a similar refractive index (RI) to enamel, but when it is removed and replaced by air, which has a much lower RI than enamel, the lesion is shown more clearly
- Fiber-optic transillumination (FOTI) is a diagnostic method by which visible light is transmitted through the tooth from an intense light source, for example from a fine probe with an exit diameter of 0.3–0.5 mm.



Although this device has the advantage that the examination is done with an operating light source already available in general practice, it is only useful for approximal and occlusal lesions; its sensitivity and specificity are not sufficient for detection of very early caries.

Besides, it is not quantitative and therefore not useful as a caries monitor over time. However, studies on the diagnostic efficacy of this device present conflicting results.





Digital Fiberoptic Transillumination

is a relatively new method of detecting Dental Caries with modern technology. In this technique of detecting Dental Caries, there is make the use of fiberoptic light for detecting caries and the image can be seen with the help of digital camera attached to it.

The main principle of detecting Dental Caries by this method was that the sound tooth materials absorbs very minimum amount of light and let the other light to pass through it but that was not true in case of affected tooth as it absorbs maximum amount of light and thus it appears dark.

Digital imaging fiber-optic transillumination

FOTI was designed for detection of approximal and occlusal caries, digital imaging fiber-optic transillumination DIFOTI is used for detection of both incipient and frank caries in all tooth surfaces.

- DIFOTI can also be used to detect fractures, cracks, and secondary caries around restorations.
- DIFOTI uses white light to transilluminate each tooth and to instantly create higher solution digital images of the tooth.
- It is based on the principle that carious tooth tissue scatters and absorbs more light than surrounding healthy tissue.
- Decay near the imaged surface appears as a darker area against the more translucent brighter background of surrounding healthy anatomy.



Quantitative Light-induced Fluorescence

Another dental diagnostic tool for detection of early carious lesions is quantitative light-induced fluorescence (QLF), which is based on autofluorescence of teeth.

When the teeth are illuminated with high intensity blue light, the resultant auto fluorescence of enamel is detected by an intraoral camera which produces a fluorescent image.

The emitted fluorescence has a direct relationship with the mineral content of the enamel.

Thus, the intensity of the tooth image at a demineralised area is darker than the sound area.

QLF uses a blue light (488 nm) to illuminate the tooth, which normally fluorescence a green colour.

Teeth should be dried before its application.



Laser fluorescence—DIAGNODent

The DIAGNODent (DD) instrument (KaVo, Germany) is another device employing fluorescence to detect the presence of caries.

Using a small laser the system produces an excitation wavelength of 655 nm which produces a red light. This is carried to one of two intra-oral tips; one designed for pits and fissures, and the other for smooth surfaces.

The tip both emits the excitation light and collects the resultant fluorescence.

Unlike the QLF system, the DD does not produce an image of the tooth; instead it displays a numerical value on two LED displays.


DIAGNODent pen

- Due to this limitation, a new version of the method was designed and introduced, named DIAGNOdent pen.
- This new version permits the assessment of both occlusal and proximal surfaces.
- The device works on the principles of the old version, but the design is different.
- The tip is rotatable around the axis of its length, enabling the operator to assess mesial and distal surfaces from both sides (buccal and lingual).
- Another cylindrical tip is recommended for occlusal surfaces, and the direction of its light is perpendicular to the axis of the length of the tip. After excitation, the tip collects the fluorescence and translates it into a numerical scale from o to 99
- . For both DIAGNOdent devices, careful tilting on occlusal surfaces around the spot to be measured is crucial for adequate detection.











Placement of sealants is a non-invasive technique (used both as primary and secondary preventive measures against occlusal caries) that maintains tooth integrity through the caries active period and will at least delay the need for an occlusal restoration until proximal lesion develops

Historically

. In 1895, Wilson reported the placement of *dental cement* in pits and fissures to prevent caries.

In 1929, Bodecker suggested that deep fissures could be broadened with a large round bur to make the occlusal areas more self-cleansing, a procedure that is called *enameloplasty*.

Two major disadvantages, accompany enameloplasty.

- *First*, it requires a dentist, which immediately limits its use.
- Second, in modifying a deep fissure by this method, it is often necessary to remove more sound tooth structure than would be required to insert a small restoration.

- In 1923 and again in 1936, Hyatt advocated the early insertion of small restorations in deep pits and fissures before carious lesions had the opportunity to develop. He termed this procedure *prophylactic odontotomy*
 - Again, this operation is more of a treatment procedure than a preventive approach, because it requires a dentist for the cutting of tooth structure..



- The major event that made resin pit and fissure sealants possible came from the early work of Buonocore (1955) who earned the title of being the
- "Father of Adhesive Dentistry" by introducing the acid etch and bonding technique for resin-based materials.
- The purpose of his original research was the development of a sealant to prevent occlusal caries on posterior teeth.
- In the 1960s, Bowen converted them to an entirely acceptable restorative group by introducing bis-GMA and including a variety of fillers for physical reinforcement and control of setting shrinkage.
- **Bisphenol A-Glycidyl Methylacrylate (Bis-GMA) Sealants** is now the sealant of choice.



Wilson and others (1985) modified this through the use of a powdered glass instead of zinc oxide and thus introduced glass-ionomer cements, which exists today as both restorative and preventive materials.

Development of occlusal caries

- the following three site-specific risk factors are associated with the development and progression of occlusal caries
- ▶ 1. Morphology of pit and fissure systems
- **2.** Eruption stage
- **3.** Functional use

Criteria for Selecting Teeth for Sealant Placement:

Previously routine all *posterior deep occlusal fissure*, *fossa or lingual pit present in teeth* because it was believed to be the only realistic way to prevent occlusal decay, but now **sealants** should only be applied *to patients and placed in teeth after careful clinical judgment of the individual*, it needs to be considered in the context of **risk factor** both **for** *individual patients and for individual teeth*



• While where caries has affected one or more permanent molar teeth, (*and those who have experienced of caries in primary teeth*) the remaining sound fully erupted pits and fissure should be sealed



- • Oral hygiene of the patient
- ► ♦ Individual history of dental caries
- ► ♦ Dietary habits
- >
 Patient cooperation and reliability in keeping recall appointments
- Tooth type and tooth morphology(fissure morphology: V, U, Y, I, IK types.

- Because the time from tooth emergence to full occlusion is the most critical period for caries initiation (*Eruption stage, Functional use*) adequate timing of sealant a The duration of the eruption period is a further risk factor.
- So teeth with longer eruption time tend to have more occlusal caries.
- For example, occlusal caries is much more prevalent in molars, which have a relatively long eruption time of 12 to 18 months, compared to premolars, with an eruption time of only a few months

A sealant is probably indicated if

- The fossa (shallow depression) selected for sealant placement is well isolated from another fossa with a restoration.
- ► ➤ The area selected is confined to a fully erupted fossa even though the distal fossa is impossible to seal because of inadequate eruption.
- The selected tooth has an intact occlusal surface when the contralateral tooth surface (surface of tooth in opposite arch) is carious or restored; teeth on opposite sides of the arches usually are equally prone to caries.
- ► ➤ An incipient lesion exists in the pit-and-fissure area.
- Sealant material can be flowed over a conservative class I composite or amalgam to improve the marginal integrity and into the remaining pits and fissures to prevent further recurrent decay

A sealant is contraindicated under these circumstances

- Patient behavior does not permit use of adequate dry field techniques throughout the procedure.
- An open, frank, carious lesion exists on the same tooth.
- Caries exist on other surfaces of the same tooth in which restoration will disrupt an intact sealant.
- A large occlusal restoration is already present

Because no harm can occur from sealing, when in doubt seal and monitor

There are two main types of materials that can be used as sealants:
Unfilled or lightly filled composite resins
Glass ionomers
Approximately 90% of the caries in permanent teeth of children occurs in pits and fissure, and approximately two-thirds of caries are on the occlusal surface alone. Similarly,
the pits and fissures of primary teeth are also at risk because roughly44% of carious lesion in the primary teeth affect the occlusal surfaces of molars



Requisites for Sealant Retention

- ▶ 1) have a maximum surface area Sealants do not bond directly to the teeth. Instead, they are retained mainly by *adhesive forces*. The surface area is greatly increased by the acid etch, which in turn increases the adhesive potential
- 2) have deep, irregular pits and fissures (Deep, irregular pits and fissures offer a much more favorable surface contour for sealant retention compared with broad, shallow fossae. The deeper fissures protect the resin sealant from the shear forces occurring as a result of masticatory movements
- 3) be clean
- 4) *be absolutely dry* at the time of sealant placement and uncontaminated with saliva residue.

Sealant Placement Guidelines

- Step 1: Prepare the Teeth (Surface Cleanliness
- Step 2: Isolate the Teeth --- a rubber dam, employment of cotton rolls, and the placement of bibulous pads high-volume, low-vacuum aspirator. Cotton roll holders may be used.
- Step 3: Dry the Surfaces (Dry teeth with air for 20–30 seconds, Check to make sure there is no moisture coming out of air syringe tip.
- Step 4: Etch the Surfaces (Increasing the Surface Area 37% phosphoric acid is applied for 20 seconds on the occlusal surface prior to the placement of the sealant, another 15 seconds of etching is indicated for fluorosed teeth to compensate for the greater acid resistance of the enamel.



- The etchant may be either in *liquid* or *gel* form. The former is easier to apply and easier to remove.
- If using a gel: applied with a supplied syringe and left undisturbed for all of time
- If using a liquid: is placed on the tooth with a small resin sponge or cotton pledged held with cotton pliers. Continue to apply etchant throughout the etchant time.
- Step 5: Rinsing and Drying the Teeth
- For 10 seconds the water from the triple syringe is flowed over the occlusal surface and hence into the aspirator tip. Then the surface is dried for 10 seconds. The air supply needs to be absolutely dry.

- The dried tooth surface should have a white, dull, frosty appearance. If there are areas at or near the opening of the pits and fissures that do not have the frosty look, then etch again
- ► The teeth *must* be dry at the time of sealant placement because sealants are hydrophobic.
- The presence of saliva on the tooth is even more detrimental than water because its organic components interpose a barrier between the tooth and the sealant



Step 6: Application of Sealant Material

With either the light-cured or autopolymerized sealants, the material should first be placed in the fissures where there is the maximum depth. sealant

At times penetration of the fissure is negated by the *presence of debris, air entrapment, narrow orifices, and excessive viscosity of the sealant*. The sealant should not only fill the fissures but should have some *bulk over the fissure*



- Following polymerization, the sealants should be examined carefully *before* discontinuing the dry field. If any voids are evident, additional sealant can be added *without* the need for any additional etching.
- Step 7: Evaluate the Sealant
- ▶ The finished sealant should be checked for retention without using undue force.
- The occlusion should be checked visually or, if indicated, with articulating paper
- ▶ a large *round cutting* bur
- Resin sealants are retained better on recently erupted teeth than in teeth with a more mature surface
- ► ✓ They are retained better on first molars than on second molars.
- ► ✓ They are better retained on mandibular than on maxillary teeth.



Teeth that have been sealed and then have lost the sealant have had fewer carious lesions .Why?

Step 8: Re-evaluation

Because the most rapid fall off of sealants occurs in the early stages(*probably caused by faulty technique in placement*), an initial 3-month recall following placement should be routine for determining if sealants have been lost *then* evaluated on a six months basis as sealant losses probably being due to abnormal *masticatory stresses*.

Fluoride-Releasing Sealants

Fluoride is added to sealants by two methods.

- The first method involves adding a soluble fluoride to the unpolymerized resin.
- The second method involves adding an organic fluoride compound that will bind chemically to the resin to form an ion exchange resin.
- Fluoride-releasing sealants have shown antibacterial properties as well as greater artificial caries resistance compared with a non fluoridated sealant.

Glass ionomer sealants

- > The main advantage of the glass-ionomer cement is
- ► A Its ability to chemically adhere to the tooth surface with minimal preparation as the acid used is, Polyacrylic acid .This diluted version does not etch the enamel but rather prepares it by increasing surface energy to improve wetting of the glassionomer sealant and improve adhesion.
- Anti-caries effect that can be attributed to both long-term fluoride release and recharge

- ► A Is a water-based material and is more technique tolerant so should be considered when:
- Four-handed dentistry is not available
- Lack of patient's full co-operation
- There is bleeding or gingival fluid seepage
- Moisture control is compromised
- Glass ionomer is best suited for protecting erupting teeth when it is inserted under the operculum.

Colored Versus Clear Sealants

- ▶ Both clear and colored sealants are available.
- > They vary from *translucent* to *white, yellow, and pink*.
- The selection of a colored versus a clear sealant is a matter of individual preference. The colored products permit a more precise placement of the sealant, with the visual assurance that the periphery extends halfway up the inclined planes.
- Retention can be more accurately monitored by both the patient and the operator placing the sealant.
- > On the other hand, a clear sealant may be considered more esthetically acceptable.
- On the other hand, some clinicians seem to prefer the clear sealants because it is possible to see under the sealant if a carious lesion is active or advancing.



Light-Cured Versus Self-Cured Sealants

	1			
type	advantage	disadvantage		
self-cure	Simple to use	1-Once mixing has started, the operator must continue		
sealant	Less expensive-does not require additional	mixing		
equipment		and immediately place the sealant, or stop and make a new mix if a problem should occur.		
		2. The catalyst and base must be mixed prior to placement, increasing the chance of incorporating air bubbles into		
		final product		
light- cure	Operator has control over the initiation of	1-Requires extra-piece of equipment that can break down.		
sealant	polymerization	2. High cost of curing light and shorter shelf-life of material.		
	2. Supplied as single liquid so no mixing			









fluoride

is the term used when fluorine is combined chemically with a positively charged counterpart. the complexes often consist of crystalline ionic salts such as fluorapatite (ca10[po4]6f2).

fluorine is never seen in nature in the elemental form because it s the most electro negative of all chemical elements. its belongs to the group of chemical elements called halogens, which refers to their ability to form salts in union with a metal







Fluoride content is commonly expressed in parts per million (ppm) which is equivalent to 1mg fluoride per kilogram or liter of water. Thus,1ppm fluoride equal to 1mg fluoride per liter of water.





In atmosphere:

fluoride originating from dust of fluoride-containing soils from gaseous industrial waste, the burning of coal fires in populated areas and from gases emitted in areas of volcanic activity in nature. The principal source of pollution are industries and mining of phosphate and fluorspar, where fluoride rich dust travel long distances by wind and enter food chain by depositing on plants. Pesticides containing fluoride can have a similar effect.

Fluoride Metabolism

The metabolism of fluoride can be divided into :

Absorption of fluoride

Approximately 75 -90 % of the fluoride ingested each day is absorped from the alimentary tract. Fluoride may also be inhaled from air borne fluoride.

Readily soluble fluoride compounds such as NaF tablets or aqueous solution of NaF are completely absorbed whereas compound with solubility such as CaF2, MgF and A1F3, are less completely absorbed.

The ingestion of fluoride with food retards its absorption. Absorption from stomach occurs readily and is inversely related to the pH of the gastric content.









- The concentration of ionic fluoride in soft and hard tissue is directly related to the amount of ionic fluoride intake. Since plasma fluoride levels are not homeostatically regulated, there is no "normal" physiologic concentration
- Plasma fluoride levels increase with age
- Fluoride balance in infants can be positive or negative during the early months of life, depending on whether intake is sufficient to maintain the plasma concentration that existed at the time of birth.

2. Fluoride in Soft Tissues

- The intracellular fluoride concentrations are from 10–50 % lower than those of plasma, but they change simultaneously and in proportion to those of plasma .
- The tissue-to-plasma ratios of radioactive fluoride are consistent with the hypothesis that hydrogen fluoride (HF) is the form in which fluoride migrates and establishes diffusion equilibrium across cell membranes.
- Since the pH gradient across the membranes of most cells can be decreased or increased by altering extracellular pH, it is possible to promote the net flux of fluoride into or out of cells.
- This is the basis for the suggestion that alkalinization of the body fluids is a useful adjunct in the treatment of acute fluoride toxicity.

3. Fluoride in Calcified Tissues

- Approximately 99 percent of the body burden of fluoride is associated with calcified tissues.
- The fluoride concentration in bone is not uniform. In long bones, for example,
- the concentrations are highest in the periosteal region .

They decline sharply within a few millimeters of the periosteal surface and increase slightly as the endosteal region is approached.

- Cancelous bone has higher fluoride concentrations than compact bone.
- Dentine and bone appear to have similar fluoride concentrations which increase with age, while that of enamel is markedly lower.
- Surface enamel fluoride concentrations tend to decrease with age in areas subjected to tooth wear but increase in areas that accumulate plaque



<section-header> Fluoride Excretion **DEDEPORT DEDEPORT DEDEPORT**



2. In Feces

Fluoride present in feces results from two sources: the ingested fluoride that is not absorbed and the absorbed fluoride that is re excreted into the gastrointestinal tract.

Fecal fluoride usually accounts for less than 10 percent of the amount ingested each day.

3. In Sweat

• Usually, only a few percent of the fluoride intake is excreted in the sweat. However, under excessive sweating as much as 50 percent of the total fluoride excreted may be lost via perspiration.

4. In Saliva

- Less than 1 percent of absorbed fluoride is reported to appear in the saliva.
- The concentration of fluoride in saliva is about two-thirds of the plasma fluoride concentration and seems to be independent of flow rate, in contrast to the situation for most electrolytes.
- In fact, saliva does not represent true excretion, because most of the fluoride will be recycled in the body. However, the fluoride content of the saliva is of major importance for maintaining a fluoride level in the oral cavity.





Fluoride supplement

1.Khawla M. Saleh

Florical Tablets

Fluoride supplements

FLUORIDE

- are available in different forms such as fluoride tablets ,drops , lozenges.
- Fluoride tablets, drops and lozenges are not available over the counter but prescribed by the dentist or paediatrician to individual patients or as a part of school or home based preventive dentistry program.

- ▶ Most commonly used is sodium fluoride .
- Other compounds used are acidulated phosphate fluoride, potassium fluoride or calcium fluoride.
- Supplements contain measured amount of fluorides, 0.25 mg, 0.5 mg, 1.0 mg.

They should be taken on daily basis according to the prescribed dosage schedule.

► The council of DENTAL THERAPRUTICS OF AMERICAN DENTAL ASSOCIATION recommends the dosage schedule for dietry fluoride supplements as shown in the table :

Age	Fluoride concentration of drinking water (ppm) (ADA 1994)			
	< 0.3	> 0.3 < 0.6	> 0.6	Florical
0-6 MONTHS	non-	-non	-non	Tablets Calcium & Fluoride Supplement 100 Tablets
6 MON TO 3 YRS	0.25 gm	-	-	Charles Paces N T
3 TO 6 YRS	0.5 gm	0.25 gm	-	
6 TO 16 YRS	1 gm	0.5 gm	-	



However fluoride supplements should be:

- I. Prescribe for children ages 6 months to 16 years who are at high risk for tooth decay.
- 2. Whose primary drinking water has a low fluoride concentration.
- 3. Prescribed only by dentists where there is clear evidence for high risk of caries and non-compliance with using other fluoridated products; and the parents must be cooperative.



Instruction to use fluoride supplement (tablet or lozenges or drop):

□ If fluoride level is unknown, drinking water should be tested for fluoride content before supplements are prescribed.

- Fluoride supplement indicated to children living in area with none or low level of fluoride in water. Especially children with high risk to dental caries, children with chronic systemic disease and handicapped children.
- Fluoride supplement is daily used from 6months to 16 years to give their maximum effect (To obtain the benefits from fluoride supplements, long-term compliance on a daily basis is required).



- ▶ □ Before considering supplementing fluoride, it is relevant to take into account the natural sources of fluoride in food and drinking water.
- ▶ □ It has also been shown that when exposure to fluoride is discontinued, its caries-reducing effect gradually wanes. This is entirely logical, because fluoride is affecting the dynamics of lesion formation.








Topical fluoride

- consider as alternative methods for the water fluoridation, and when fluoride therapy is required.
- topical fluoride is use of systems containing relatively large concentrations of fluoride that are applied locally or topically, to the erupted tooth surface to prevent the formation of dental caries.



Home Topical Fluorides Application	Professional Topical Fluorides Application	
used at <u>home</u>	used at in the <u>clinics</u>	
contain comparatively <u>less amount</u> of fluoride and are used <u>daily</u> or <u>regularly</u> .	contain very <u>high</u> <u>amount</u> of fluoride and are applied <u>less frequently</u> , majority being biannually.	



Disadvantages of topical fluoride:

- ▶ 1. Person must remember to use.
- ▶ 2. High cost compared to water fluoridation.
- 3. More concentrated professional use products can cause short-term side effects like nausea immediately after use.

The efficacy of topical fluoride depends on:

- ▶ a. The concentration of fluoride used.
- b. The frequency with which it is applied and the duration of application.
- c. The specific fluoride compound used.



Fluoride Compounds

▶ 1- Inorganic compounds:

- Sodium fluoride (NaF): used in dentifrices, mouth rinses, chewing- gums, Solutions, gels ,varnishes, prophylaxis pastes.
- Ammonium fluoride (NH4F): due to its unpleasant taste and lack of superiority in clinical performance over NaF Formulations used in solutions.
- Titanium tetrafluoride (TiF4): able to reduce enamel solubility, and due to the formation of a glaze on enamel and dentine.
- ► ➤ Monofluorophosphate-containing compounds.
- 2- Organic compounds: Amine fluoride which used in dentifrices, gels, mouth rinses, prophylaxis pastes.

Fluoride Therapy



- Topical Fluorides
 - Delivered via gels, varnishes, mouthrinses, prophy pastes and dentifrices
 - No need for topical fluoride in patients with low risk and/or residing in optimally fluoridated areas- use of a fluoridated toothpaste should be sufficient.
 - Fluoridated dentifrices are not recommended in small children (<3 years)

INDICATIONS

- ▶ 1.Caries active individuals
- 2.Children shortly after periods of tooth eruption, especially those who aren't caries free.
- 3.Those who take medication that reduce salivary flow or radiation therapy.
- ▶ 4.Post periodontal surgery when roots are exposed

Topical fluorides are divided into two categories

- Involve the use of high fluoride concentration products ranging Professionally applied topical fluorides:
- > It was introduced by Bibby in 1942.
- I from 5000-19,000ppm, which is equivalent to 5-19 mgF/ml



- > Include fluoride dentifrices, mouth rinses & gels
- Are low fluoride concentration products ranging from 200-1000ppm or 0.2-1 mgF/ml.

Topical fluorides

- Gel and solutions indicate that both are the same order of clinical effectiveness .
- A gel is an aqueous suspension of organic or inorganic molecule that are arranged in a weak three dimensional network producing a thickening or gelling of the entire mass

Advantages of gel

- 1. A dhares to teeth surface
- 2. Less time consuming
- Hazards of accidently ingesting a large quantity of F is minimized
- 4. eliminates the need for continuous wetting of enamel surface required by the operator



Sodium Fluoride solution and gel NaF 2%,0,1%

- Maximum reduction of caries at 4 application by weekly intervals at age 3,7,10,13years.(knutson tech.)
- 1. First visit ,prophylactic scaling and polishing
- 2. Flossing
- 3. Applied NaF in quadrant after isolation and dryness For 4 minutes /quadrant.
- 4.Instraction the patient
- ▶ Reduction of caries 20-40%
- ▶ IF the conc. Is 0.1% the appl. For 7-8 min.



Advantages of NaF

- ▶ 1.Effective in reducing dental caries in children
- > 2.Used for sensitive teeth as desensitizing agent
- ► 3.taste is good
- ▶ 4.stable i.e no need to prepare it fresh
- ▶ 5.Don't give discoloration



Disadvantages of NaF

- ▶ 1.long procedure for application
- ▶ 2.not effective in adult .
- 3.only effective in children living in non fluoridated area







Health education

is defined as any educational activity which aims to achieve a health related goal or Health education is a process that informs, motivates and helps people to adopt and maintain healthy practices and lifestyles, advocates environmental changes as needed to facilitate this goal and conducts professional training and research to the same end.





2.Motivating people:

• People must be motivated to change their habits and ways of living as many current health problems are directly related with them for example drug addiction, cigarette smoking, pollution of water, sedentary lifestyles, etc

3. Guiding into action:

- The people should be encouraged to use wisely the health services available to them.
- They may need help to adopt and maintain healthy lifestyles and practices which may be new to them





3-Comprehension

- It means capacity of understanding.
- An educator needs to know the level of understanding and education of the people towards whom the program is to be directed.
- The educator must try to educate in local language as much as possible or use language which people understand. Scientific or strange words which are difficult to understand must be avoided.





6-Learning by Doing Hearing and seeing

does not make an individual a good user. Its only when they do the new thing, they can really appreciate new practice. So, the people should be motivated to do the new practice to understand it.

This principle of learning by doing is based on a famous Chinese proverb "IF I HEAR, I FORGET; IF I SEE, I REMEMBER; IF I DO, I KNOW"









COMMUNICATION

• The art and science of communication forms the foundation of oral health education and disease prevention. Although, it was known that telling people is not enough to cause a change in behavior, often the way in which they are told is the most important factor in communication effectively

Description of the second se

2-Audience

They are the receivers of the health message. They are the target groups who need advice or the health message.

• They can either be the whole population or selective group like industrial workers, school children, expectant mothers etc.







STEPS OF LEARNING

People are unaware of certain habit or behavior which is detrimental to their health.

Awareness is given to them by giving them information.

The information becomes relevant if it is conceived by them with selfinterest, otherwise the facts are irrelevant.

- Only after the information has been accepted by an individual, a positive attitude can be adopted by the individual.
- A positive attitude towards the message may enable an individual to believe that a change in behavior is required and is beneficial for him. But an action may not necessarily follow. A commitment is necessary to bring about a permanent behavior change







DENTAL CARIES



The term dental caries (tooth decay or cavity) is used to describe the results (the signs and symptoms) of a localized chemical dissolution of the tooth surface caused by metabolic events taking place in the biofilm (dental plaque) covering the affected area .

It is a multifactorial disease characterized by "demineralization of the mineral components and dissolution of the organic matrix". The destruction can affect enamel, dentin and cementum. **Carious process** is the result of an interaction of the following: 1- Host.

2- Plaque.

3- Diet.

4- Time.

The multifactorial complexity of dental caries can be explained simply by the following figure:



2 FACTORS AFFECTING CARIES PROCESS:



Host Factor: This involves susceptible tooth and saliva.

The tooth: Several factors affecting tooth susceptibility are:

I- Morphology of teeth:



Dental caries lesions may develop at any tooth site in the oral cavity where a biofilm develops and remains for a period of time. pits, grooves and fissures in occlusal surfaces, proximal surfaces cervical to the contact point/area and along the gingival margin. These are the sites where lesion development is more likely to occur because the biofilm is allowed to stagnate there for prolonged time

Certain surfaces of a tooth are more prone to caries whereas other surfaces rarely show caries

For example, in mandibular 1st molars the caries in descending order is

occlusal, buccal, mesial, distal and lingual.

2- Position of teeth:

Anterior teeth are less affected by dental caries compared to posterior teeth.

The most susceptible permanent teeth are the mandibular first molars, followed by the maxillary first molars and the mandibular and maxillary second molars. The second premolars, maxillary incisors and first premolars are the next in sequence.

While the mandibular incisors and canines are the least susceptible teeth to develop caries

3- Composition of teeth:

The tooth is composed mainly of inorganic elements (96% in enamel and 70% in dentin) and the remaining are organic materials and water. Composition of teeth is affected by environmental factors (water, diet and nutrition).

Inorganic components involve:

Major elements: calcium, phosphorous, hydroxyl group {Ca10 (PO4)6(OH)2} hydroxyapatite crystals.

Minor elements: Zinc, copper, strontium, magnesium, fluoride, etc.

Some of these elements may increase the resistance to caries like fluoride, zinc and others.

accumulation of these elements will results in changes of the enamel (decrease in density and permeability, an increase in fluoride content) with age .

While other elements such as magnesium may increase the susceptibility of teeth to caries.

It had been found that substitution of hydroxyl group by fluoride ion results in formation of fluoroapitite crystals {Ca10 (PO4)6F2} that increase tooth resistance to caries. The accumulation of these elements will results in changes of the enamel (decrease in density and permeability, an increase in fluoride content) with age.

4

The organic constituents and water of both enamel and dentin may act as a diffusion pathway for bacterial acids increasing the tooth destruction. In other way, they permit the penetration of ions for physiological remineralization- demineralization process.

Such voids in enamel as well as proteins act as a caution for intense biting pressure to prevent fracture.

SALIVA:

through its secretion and composition affects dental caries development.

buffer system in saliva affects the integrity of teeth as

It can affect the number of microorganisms through cleansing action (oral clearance), While buffer system in saliva affects the integrity of teeth as well as calcium and phosphate.







The cariogenic bacteria in plaque consist of *mutans streptococci*, *lactobacilli* and other types

Bacteria ferment carbohydrate causing release of acid lead to demineralization of tooth surface.

Plaque accumulation may show individual variations and affected by many factors such as age and practices of oral hygiene.

DIET:

It may exert an effect on caries locally in the mouth by reacting with the enamel surface and by serving as a substrate for cariogenic microorganisms. Frequent consumption of sweets between meals lead to continuous drop of pH, thus demineralization will occur.

TERMINOLOGY OF CARIES

Dental caries may be classified in a number of ways, according to their anatomical sites.

A.Pits and fissures caries is a lesion affected pits and fissure sites of tooth surfaces.

B.- Smooth surfaces caries is lesion that may start on smooth enamel as buccal/labial or interproximal surfaces

C.- Arrested caries is a lesion that may have formed years previously and then stopped further progression.







D. Rampant caries is the name given to multiple active carious lesions occurring in the same patient.

E. Nursing bottle caries is one type of rampant caries in the primary dentition of infants and young children, result from a sleep sucking bottle.









DYNAMICS PROCESS OF DE-/REMINERALIZATION

Dental caries is a disease that is manifested as a dynamic process of de/remineralization in the mouth

Demineralization is a continual imbalance between pathological and protective factors that results in the dissolution of apatite crystals and the net loss of calcium, phosphate, and other ions from the tooth. 6

The oral fluids (saliva, biofilm fluid)

have calcium (Ca) and phosphate (P)

in supersaturated concentrations

with respect to the mineral composition

of enamel.

(a neutral pH of 7) physiological conditions



- 1. The tooth is attacked by acids in plaque and saliva.
- 2. Calcium and phosphate dissolve from the enamel in the process of demineralization.
- 3. Fluoride, phosphate and calcium re-enter the enamel in a process called remineralization.

At a pH of 5.5, under saturation begins, that is, the calcium and phosphate ion concentrations in the plaque fluid are not sufficient to maintain the enamel in stable equilibrium; thus, the enamel starts to dissolve

The term "remineralization" is used to describe mineral gain. Remineralization is the body's natural repair process for subsurface non-cavitated carious lesions.

De-/remineralization cycles continue in the mouth as long as there are factors including cariogenic bacteria, fermentable carbohydrates, and saliva.

The balance between pathological factors and protective factors determines whether demineralization or remineralization is proceeding at any one time.



THE DEVELOPMENT OF A CARIOUS LESION OCCURS IN THREE DISTINCT STAGES:



The earliest stage :

stage is the incipient lesion; macroscopically evidenced on the tooth surface by the appearance of an area of opacity (the white spot lesion),

The second stage

includes the progress of the demineralization front toward the dentino-enamel junction and/or into the dentin; the affected dentin displays discoloration from brown to dark brown or black,

The final phase

of caries development is the development of the overt or frank lesion, which is characterized by actual cavitation.





- Traditional dental restoration was based on the principle created by G.V. Black in 1908, removing a lesion by operation and then restoring the damaged part.
- Modern material science proved that dental restoration material could not match the healthy dental tissue in terms of physical, mechanical, and biological properties.
- Removing healthy dental tissue and restoring the cavities with traditional filling material certainly could not meet the functional requirements.


NOTE



NOW They focus on the preservation of healthy dental tissue when removing caries lesions, instead of the "extend to prevent" principle of G.V. Black





MODERN CARIES TREATMENT PAYS MORE ATTENTION TO THE

- biological response of the pulp-dentin complex
- to the relationship between the restored tooth and periodontal health
- between occlusion and periodontal health
- proximal contact between the prosthetic and the adjacent teeth





In the past it was thought that the demineralized layer should be removed, but now they suggested that the demineralized layer is a precarious status instead of cariesactive status, this layer can be remineralized.

modern view is that the removal of diseased tooth structure should be limited to the infected layer(minimal surgical intervention) by new technologies including *sandblasting caries removal, LASER, chemical–mechanical caries removal,* and other,

NON-MACHINERY PREPARATION



Air Abrasion The principle of air abrasion is to apply highly pressurized, nontoxic particles, such as aluminum oxide ions, to accurately remove the enamel, dentin, carious tissue, and old fillings.



NDAGES OF AIR ABRASION

• Air abrasion can partially replace the high-velocity gas turbine cavity preparation.

- It is quieter,
- more time- and energy-efficient,
- and requires no anesthesia as it does not produce vibration and heat.
- It is well received by patients and maximizes the conservation of the tooth structure.
- The interior of the prepared cavity is smooth, making it easier to fill.
- It reduces the likelihood of micro-fracturing.

- *The disadvantage* of this method is that because
- it is easier to remove dentin than enamel, it causes the overhang of enamel,
- which requires trimming of the enamel with the drill.

CONTRAINDICATIONS TO AIR ABRASION DECLUSE PATIENTS WITH:1. A severe allergy to dust, asthma, and chronic obstructive pulmonary disease. 2. Open wound or recent tooth extraction. 3. Active periodontal disease. 4. Recent placement of an orthodontic appliance

• 5. Subgingival caries



- Laser cavity preparation is precise,
- non -vibrating,
- has no smell,
- and does not require anesthetics.
- As lasers can seal dentinal tubules,
- they can also prevent hypersensitivity postoperativery.
- On the downside, the machinery is bulky and expensive, thus limiting its role in clinical practice.





INDICATION OF CMCR METHOD





- root/cervical caries,
- coronal caries (especially deep coronal caries),
- caries located on the edge of the crown or bridge abutment,
- completion of canal preparation,
- those in whom anesthetic is contraindicated, especially needle-phobic patients, those with a dental phobia, and pediatric patients.

PREVENTIVE RESIN RESTORATIONS



- Preventive resin restorations only remove the infected enamel or dentin at the lesions, according to the size of the caries, using etching technology and the resin material filling up the early fissure caries, and the occlusal surface coated with sealant.
- It is a preventive measures combined between pits and fissure sealing and fissure caries filling.

- it does not use the traditional extension for prevention, only amount of carious tissue is removed and restored with composite resin or glass ionomer,
- thus preserving more healthy dental tissue, and is an effective method for preventing the further development of caries.
- The advantage of preventive resin restorations is using glass ionomer composite resin as filling and binding with enamel mechanically or chemically, and then bonding with sealant by chemical bonding reduces the possibility of generating micro-leakage

REMINERALIZATION TREATMENT

- For early enamel earies that have been demineralized, the appropriate drug treatment to remineralize, is called remineralization treatment.
- In recent years, Early enamel caries on the smooth surfaces (buccal, labial, lingual, palatal or proximal), such as white spots, and people susceptible to caries are suitable for remineralization therapy.

- There are many types of mineralized fluid, which divided into
- single component
- and complex components.
- The single component is mainly fluorine-containing, the complex component mainly containing different ratios of calcium, phosphate, and fluoride salts, while calcium or fluoride salt is the main ingredient

- a new remineralization agent, casein phosphopeptideamorphous calcium phosphate (CPP-ACP), has been used clinically. CPP-ACP has a wide range of applications in biology, including the promotion of remineralization of the tooth surface and bone calcification,
- promoting the absorption of minerals, and has an effect on cariogenic bacteria.

Currently, CPP-ACP is used in the treatment of

- a. early caries remineralization,
- b. dentin hypersensitivity,
- c. dental erosion treatment,
- d. and as prevention in caries-susceptible patients

The remineralizing agent with CPP-ACP as the main ingredient shows broad application prospects in caries prevention.

SEALING OVER CARIES LESIONS

Clinicians are often concerned regarding the inadvertent sealing of surfaces that are already carious because of the possibility that sealed lesions will remain active.

many studies have shown that carious lesions that are effectively sealed do not progress for as long as 3-5 years.

 care should be taken to monitor their retention at subsequent recall/annual dental examinations. Sealed lesions generally become arrested because the microorganisms do not remain vital within the lesion and what bacteria remain are not capable of maintaining progression of the lesion in addition, the acidetching process alone can reduce the bacterial load

SEALANTS FOR PROXIMAL ENAMEL SURFACES

- Adhesive resins can be applied for sealing early carious enamel lesions on proximal surfaces in order to arrest their progression .
- The proximal sealant technique is likely to be suitable for the primary dentition as the progression of enamel caries into dentine occurs relatively quickly,
- and the timely placement of sealants can halt progression of the lesions.



- this technique may be hampered by the requirement for separation of the teeth prior to placement of the sealants that usually involves two appointments, so it is not practical for young children.
- An alternative method would be to seal the teeth while it is possible to gain access to the proximal smooth surfaces before the contacts with adjacent teeth are established











NON- SUGAR SWEETENERS L.KHAWLA.M.SALEH PREVENTIVE DENTISTRY





- Taste recognition occurs when the receptor sites of the cells of the taste buds carry, by cranial nerves, a qualitative and quantitative message to the brain.
- The messages are processed, and the stimulus is recognized as either sweet, sour, salty, or bitter, or some combination of these four taste.



The sweetness of sugars

- all sugar contributes sweetness to food, but the relative sweetening power varies among sugars.
- the more easily the sugar dissolves in water the greater its sweetening power.
- For example, fructose is 75%sweeter than any other sugar. It is soluble in water; difficult to crystallize, as a result its expensive, it's useful in syrup.
- At the other extreme, the least sweet, least soluble sugar is lactose, because it is almost impossible to dissolve in the food to be sweetened.





- Taste buds are present and functioning before birth, a fact demonstrating by injecting sweetening agents into the amniotic fluid results in an increased rate of swallowing by the fetus.
- At birth, infants show a taste preference for sucrose, and their taste cells are more responsive to sucrose than other sugar and the newborn baby respond unfavorably to a bitter substance.

 It is important for both the therapist and the patient to know that sugar is available for bacteria in the plaque long after the sugar concentration in saliva has reached levels below the taste threshold for sugar



Non- sugar sweeteners

- sometimes referred to as sugar substitutes, sugar replacers or alternative sweeteners
- Sugar substitutes can be separated into two major groups:
- 1. bulk sweeteners (nutritive, caloric)
- 2. Intense sweeteners (non-nutritive, noncaloric),
- some of these are naturally occurring compounds. Grouping sweeteners as "nutritive" or "non nutritive" acknowledges a difference in the amount of energy provided by the sweetener.

Bulk sweeteners (caloric)

- Many of the bulk sweeteners are sugar alcohols, and being chemically similar to sugars, they have a similar caloric content to sucrose, the most commonly known include sorbitol, mannitol, and xylitol.
- Because sorbitol and mannitol are only half as sweet as sucrose, there may be a tendency to increase caloric intake with the use of these two compounds.
- Xylitol has the same sweetness as sucrose.
- Bulk sweeteners have similar physical characteristics as sucrose, and their substitution does not change the customary size and weight of a product (add volume and sweeteners to a product)

disadvantages

the bulk sweeteners is that they are only partially absorbed in the small intestine and pass the colon where they may induce osmotic diarrhea.

Bulk sweeteners are therefore not recommended for children under three years of age and care must taken with sugar-free medicines containing bulk sweeteners, since high intakes cause gastrointestinal disturbance.

1-Sorbitol:

- used extensively as a non- sugar sweeteners in confectionery, chewing gum, liquid oral medicine, and toothpastes t is a derivative of glucose,
- occurs naturally in such fruits as apples, pears and peaches and in several vegetables.
- It is not actively absorbed from the gastrointestinal tract and is absorbed at about one third of the rate of glucose absorption.

- This means that eating food rich in sorbitol allow blood glucose level to remain above the fasting level for a longer time than dose eating food correspondingly rich in glucose.
- Thus eating sorbitol may delay the onset of hunger. For this reason,
- sorbitol is an ingredient in some foods designed for use in weight – reducing diets and has been used clinically as noninsulin stimulating carbohydrate, so used in diabetic foods

- sorbitol is less cariogenic than sucrose, as it fermented slowly by plaque organisms, and the rate is very much slower than that for glucose and sucrose.
- Sorbitol and sorbitol- containing products are considered safe for teeth but the oral microflora may adapt to sorbitol so that it loses its safety for teeth property

- 2-Mannitol less popular than sorbitol, partly because of its higher price, and they have a similar dental properties. It is used in toothpaste
- **3-Xylitol** It is the best nutritive sucrose substitute with respect to caries prevention.

Xylitol can be considered as non-cariogenic and anticariogenic that prevent dental caries.

It's non-fermentability in plaque and its saliva stimulating effect may support this statement. mouth rinses and as a dusting agent for chewing gum.

• Xylitol may have an anti-microbial effect since the plaque accumulation after xylitol consumption is reduced and there is a good evidence that the ability of plaque to produce acids by metabolism of sugar reduced by xylitol. This seems to be explained adequately by the decrease in S. mutans in plaque exposed to xylitol and possibly a decreased in plaque quantity

Intense sweeteners (non-caloric)

- called intense sweeteners because they have sweetness hundreds to thousands of time than sucrose.
- They are safe for teeth because they cannot act as an energy source for dental plaque microorganisms and acid cannot be derived,
- a non-carious product that could be used in oral medication, mouth rinses, toothpaste and all form of candy is highly desirable.
- They are chemically very heterogeneous group, and are not chemically related to sugar.
- They are not metabolized to acids by the oral microorganisms and they cannot cause dental caries. Thus, they are a perfect as far as dental caries is concerned.

- disadvantages in taste, stability, lack of volume,
- although a sweeteners with a low physical weight is also highly desirable for reducing the size of product packages.
- The most popular intense sweeteners are:
- 1-Saccharin
- 2-Aspartame
- 3-Acesulfame K



- -Saccharin: is a considered **approximately300 time** sweeter than sucrose. Due to its intense sweetness,
- the use of saccharin is only about 4% as costly as an equivalent sweetness derived from sucrose;
- it is compatible with most food and drug ingredients.
- It has a bitter taste in concentration over 0.1%, although the perception of this varies between individual.
- Saccharin has been reported to inhibit bacterial growth and metabolism **but its caries inhibiting effect are small**

- **2-Aspartame:** It is a dipeptide consisting of aspartic acid and phenylalanine.
- It is approximately 200 times sweeter than sucrose with a similar taste to sucrose.
- Individuals with **phenylketonuria**, who have a genetic defect of phenylalanine metabolism, should avoid ingestion of aspartame

- Acesulfame K: It is approximately 200 times sweeter than sucrose. It has a pleasant sweet taste.
- Its sweetness is quickly perceptible and diminishes gradually without any unpleasant aftertaste.
- It is thought to have a good potential as a sweetener in most classes of food and drinks and useful sweetener in boiled sweet and preserves.

Protective factors in food

- food component (dietary factors) that counteract the damaging effects of carbohydrates and have anti-cariogenic (caries inhibiting) properties are sometime referred to as cariostatic (protective) factors,
- fluoride are undoubtedly the most effective of these factors.

- **Phosphate:** The possible caries inhibiting effect of various phosphates, which are found naturally in many foods.
- The most promising of the organic phosphates was **phytate**, identified as the most active substances **in unrefined cereals**.
- The effectiveness of phytate appears to be due to its ability to adsorb readily and firmly to enamel surfaces and so prevent the dissolution of enamel by acids.

- Some investigators have found statistically significant reduction in caries increment by adding 1-3% of sodium phosphates or calcium sucrose phosphate to various foods or chewing gum,
- one major problem is that phosphate when added to sucrose, are cleared from saliva faster than sugar and fail to produce substantial increases in the phosphate concentration of human plaque.
- Other problems could possible risk of increased dental calculus formation or pathological calcification of internal organ

Fats:

- Action of the Fats:
- seems to reduce the cariogenicity of food, they may act merely by replacing carbohydrate in the diet.
- Fat may also form a protective barrier on the enamel, or surround the carbohydrates, making these less available and speeding up their removal from the mouth.
- Bacterial surface properties involved in plaque formation could also be altered by fats.
- Certain fatty acids have antimicrobial effect and have been shown to inhibit glycolysis in human dental plaque

Milk and cheese:



- Milk is considered non- cariogenic or even anticariogenic in spite of the fact that lactose is fermented by dental plaque but its less acidogenic than other mono and disaccharides.
- On the other hand, milk has a combination cariostatic component in the readily available form: protein (casein), calcium and phosphate, calcium and phosphate that present in high concentration are able to prevent enamel demineralization.

- Human breast milk is higher in lactose and lower in phosphorus and calcium; however, the epidemiological studies have associated breast-feeding with low level of dental caries.
- Breast feeding provide no opportunity to added additional sugar to milk feeds and breast-fed infant are perhaps less likely to use baby bottles containing sugary liquids, however prolonged, and nocturnal suckling have been associated with increased caries risk.

• The evidence from many studies shows that cow's milk a non-cariogenic drink suitable for use as an artificial saliva in caries prone xerostomic patients, since it appear to have caries protective properties.



- I. Consuming cheese following a sugary snack virtually abolish the usual fall on pH that is associated with sugars consumption.
- II. Cheese stimulates salivary secretion due to its sharp testing,
- III. the high protein (casein) calcium and phosphorus content seem to be another factor in the cariostatic mechanism of cheese as it increase their concentration in dental plaque,



IV. the calcium concentration within dental plaque strongly influences the balance between de- and remineralization of ename

Fruit and dental caries

- Health report throughout the world encourage increased consumption of fruit and vegetables,
- also they reported that in order to reduce the risk of dental caries, consumption of non-milk extrinsic sugars should be decreased and that sugars should be replaced by fresh fruit vegetables, and starchy food.
- It is also preferable to consume whole fresh fruit as opposed to juices, because their mastication provides a good stimulus to salivary flow,
- in addition fresh fruit juices contain non-milk extrinsic sugars, since liquidation release the fruit sugars from cellular structure of the fruit





Testing food cariogenicity

- numerous studies have focused on methods to evaluate food cariogenicity,
- most often by the use of pH assessment of dental plaque exposed to the food items in question
- There is no doubt that it's easy to rank the relative cariogrenic potential of a variety of foodstuffs by evaluating and comparing the Stephan curve derived when each foods are eaten under controlled condition.
- Ranking of food, according to their capacity to induce a pH drop in dental plaque should therefore only be considered as gross estimates of their relative cariogenicity





Plaque control

is the removal of microbial plaque and the prevention of its accumulation on the teeth and adjacent gingival tissues, it also deals with the prevention of calculus formation and leads to resolution of gingival inflammation.

▶ Plaque control

Plaque control includes mechanical procedures (includes tooth brushing and interdental cleaning aids and professional prophylaxis) and chemical agents which retards plaque formation.

- ▶ In periodontal therapy, plaque control serves two purposes:
- ▶ 1. To minimize gingival inflammation.
- 2. To prevent recurrence or progression of periodontal disease in treated mouth.
- The process of plaque control requires motivation on the part of the patient, education and instruction, followed by encouragement and reinforcement.

Mechanical plaque control aids include:

1. Tooth brushes:

They were first introduced in China as early as 1600 B.C.

Through the years toothbrushes have undergone changes in many ways as possible.

is an oral hygiene tool used to clean the teeth, gums, and tongue It consists of a head of tightly clustered bristles, atop of which toothpaste can be applied, mounted on a handle which facilitates the cleaning of hard-to-reach areas of the mouth.

Objectives of Toothbrushing:

- □ To clean the teeth and interdental areas
- □ To prevent plaque formation.
- □ To stimulate and massage the ginival tissue
- □ To clean the tongue



Types of tooth brushing

- Manual toothbrush.
- Powered toothbrush.
- Sonic and ultrasonic toothbrush.
- lonic toothbrush.



Manual toothbrush:

It should be easily and effectively manipulated, inexpensive. Parts of toothbrush:

1. Handle: The part grasped in the hand during tooth brushing.

2. Head: The working end of a toothbrush that holds the bristles.

3. Tufts: Clusters of bristles secured into head.

4. Shank: The section that connects head and handle

- Toothbrush bristles either
- natural from hair of hogs or synthetic from nylon (not larger than 0.23 mm in diameter) which are uniform in size and elasticity resistant to fracture.
- ▶ Rounded bristles ends cause fewer scratches on the gingiva.
- ▶ The type of brush is a matter of individual preference.
- A toothbrush should be able to reach and clean most areas of teeth.
- For maintenance of toothbrush; most brushes wear out in three months and should be replaced, it should be stored in dry areas and cleaned in antiseptic mouthwashes

Tooth brushing methods:

Bass method:

It is the most widely accepted and most effective method for dental plaque removal, adjacent and directly beneath the gingival margin.

technique is place the bristles at 45° angle to the gingiva and move in in back and forth motions. Strokes are repeated around 20 times.

Advantages: Effective method for removing plaque from the cervical area beneath the height of contour of enamel, easy to learn, provides good gingival stimulation and recommended for patient with or without periodontitis



Modified Bass technique:

This technique combines the circular motions of Bass technique with the sweeping motion of the Roll technique. It has sweeping motion from cervical to incisal or occlusal surface.

The bristles are gently vibrated by moving the brush handle in a back and forth motion.

Advantages: Good interproximal, gingival and sulcus cleaning as well as good gingival stimulation.

MODIFIED BASS TECHNIQUE

This method differs from bass technique in that it has sweeping motion from cervical to incisal or occlusal surface.

INDICATION:

- As a routine oral hygiene measure.
- Intrasulcular cleansing.

ADAVANTAGE:

- Excellent sulcus cleaning.
- Good inter proximal and Gingival cleaning.
- Good gingival stimulation.

DISADVANTAGE:

Dexterity of wrist is required.





Toothbrush positioned on facial and maxilloproximal surfaces of maxillary molars.

Palatal position on molars and pre molars.



Stillman's method:

- The bristles are positioned apically along the long axis of the tooth.
- The edge of the brush head should be touching the facial or lingual aspect of the tooth.
- The brush is slightly rotated at a 45-degree angle and vibrated over the crown.
- Advantages: It is used for massage and stimulation of gingiva and for cleaning the cervical area of the teeth.
Modified Stillman's method:

- The bristles are positioned partly on the cervical portion of teeth and partly on the adjacent gingiva in an apical direction with an oblique angle to the long axis of the tooth.
- ▶ Roll the brush down to the crown of the tooth.
- Advantages: It is recommended for cleaning in areas with progressing gingival recession and root exposure to prevent abrasive tissue destruction.





Scrub brush method:

- The teeth are placed edge to edge while the brush maintains a 90-degree angle to the long axis of the tooth.
- ▶ The brush is then moved in a horizontal stroke.
- This technique is known to cause excessive toothbrush abrasion.



Roll technique or sweep method

The bristles are placed at 45° angle and lightly rolled across the tooth surface toward the occlusal surface.

The edge of the brush head should be touching the facial or lingual aspect of the tooth. Then with light pressure, the bristles are rolled against the tooth from the apical position toward the occlusal plane.

This motion is repeated several times; then the brush is repositioned on the next teeth with bristles overlapping a portion of the teeth previously cleaned.

The heel or toe of the brush is used on the lingual aspect of the anterior teeth. It is indicated for children and for individuals with limited dexterity.

Advantages: It works fairly well for patients with anatomically normal gingival tissues.

Fones method or circular scrub method:

The teeth are clenched, and the brush is placed inside the cheeks. The brush is moved in a circular motion over both maxillary and manibular teeth.

In the anterior region, the teeth are placed in an edge-to-edge position and the circular motion is continued. On 5 the lingual aspect, an in-and-out stroke is used against all surfaces.

This technique can be damaging if done too vigorously

. Advantages: It is recommended for children and physically or emotionally handicapped individuals.

Benefits Of Manual Toothbrushes

- Inexpensive.
- Available with a variety of styles, heads and bristles.
- Easy to take on trips.
- No batteries or charging requirements.
- Easy to replace if damaged or lost



ELECTRIC TOOTHBRUSH?

- An electric toothbrush is a battery operated brush and when the button is pressed, its head starts oscillating, rotating, or vibrating, which helps clean the teeth effortlessly.
- In an ordinary electric toothbrush the frequency of oscillation may be around 40 Hertz (HZ).



Advandages

- Superior Plaque Removal.
- Ease of Use.
- Technology and Features.
- More Cleaning Power.
- Oscillating/Rotating/Pulsating Technology
- Dentist-Inspired Brush Head.
- Two-Minute Timer.
- Modes.



The indications for uses are:

- Young children.
- Disabled patients.
- Individuals lacking manual dexterity.
- Patients with prosthodontics, or orthodontic treatment as well as implants.
- Patients on supportive periodontal treatment. -Institutionalized elderly peoples.

Sonic and ultrasonic toothbrush:

- An ultrasonic toothbrush is a manual toothbrush with a piezoelectric ultrasonic transducer (a device used to convert energy into ultrasonic vibration
- These types produce high frequency vibrations (200-400 HZ for sonic and 1.6 MHZ for ultrasonic),
- which lead to the phenomenon of disruption of bacterial cell wall (bactericidal) and aids in stain removal

Ionic toothbrush:

- This type changes the surface charge of a tooth by influx of positively charged ions.
- The plaque with similar charge is repelled from the tooth surface and is attracted by the negatively charged bristles of the toothbrush.
- It indicates a brush that aims to impart an electrical charge to the tooth surface with the intent of disrupting the attachment of dental plaque.







INTRODUCTION

Black made a prophetic statement "The day is surely coming and perhaps within the lifetime of you young men before me when we will be engaged in practicing preventive rather than reparative dentistry



Dr. Greene Vardiman Black (1836-1915)

DEFINITIONS

PREVENTIVE DENTISTRY -



It is that specialized branch of dentistry which deals with the prevention and interpretation of the progress of all dental and oral diseases, prevention and limitation of disabilities and provides rehabilitation.

CONCEPTS OF THE PREVENTIVE DENTISTRY

Old concept • The concept of prevention is the maintenance of oral health, rather than treatment, but may be considered as the basis for treatment planning.

 Economical and effective Spans from womb to tomb
 Team work including dentists and patients
 Continuous Process





Concept of positive health

Encourages achievement and maintenance of an **acceptable level of health.**

- that will enable every individual to lead a socially and economically healthy life
- "prevention is better than a cure."

Is preventive dentistry still needed?

- As decay rates decline, dentists turn their interest to previously underutilized therapies such as cosmetic dentistry, orthodontics, third molar extractions, implant dentistry, and so on that need improved preventive care
- The frail elderly is the fastest growing segment of the population, and they will need even more preventive care because of their increased risk for disease.
- Dental disorders are an enormous burden to society, especially when considers the connection between poor oral health and systemic illness



Primordial prevention



- It is the prevention of emergence or development of risk factors (beginning with change in social and environmental conditions) in countries or population group in which they have not yet appeared.
- Individual and mass education is main intervention method in primordial prevention.

Primary Prevention (Prepathogenesis)

- It is defined as 'action taken prior to the onset of the disease, which removes the possibility that a disease will even occur'.
- It is carried out on healthy populations.
 Information and / or public health measure for the whole population may be sufficient to maintain a disease free environment, this is the goal of primary prevention.





a. Health promotion

. It is process of enabling people to increase control over and to improve health. This can be achieved by

- 1) Health education; instruction on proper plaque removal, daily tooth brushing and flossing
- 2) Environment modification such as safe water, control of insects
- 3) Nutritional interventions: improvement of nutrition in vulnerable group.
- 4) Lifestyle and behavioral changes; which favor health

Primary prevention:

B. Specific protection
1.Immunization and prophylaxis
2.Use of specific nutrients or supplementations
3.Protection against occupational hazards
4.Safety of drugs and foods
5.Control of environmental hazards

SECONDARY PREVENTION AND EARLY INTERVENTION







It is defined as " action which halts (stop) the progress of a disease at its incipient stage and prevents complications." Reverse the initiation of disease. An outcome of good health can still be achieved





Tertiary Prevention (Pathogenesis: Late Stage of Pathogenesis)

- It can be defined as 'all measures available to reduce or limit impairments and disabilities, minimizing suffering caused by existing departures from good health and to promote the patients adjustment to irremediable conditions'.
- The goal of tertiary prevention is to reduce the negative impact of an already-established disease by restoring function and reducing diseaserelated complications

• Tertiary prevention also aims to improve the quality of life for people with disease.

Tertiary Prevention



All measures available to reduce or limit impairments and disabilities, minimize suffering caused by existing departures from good health and to promote the patients adjustment to irremediable conditions



Disease ightarrow impairment ightarrow disability ightarrow handicap

A.*Disability limitation* →early symptomatic disease

B.**Rehabilitation** \rightarrow late symptomatic disease

IMPAIRMENT Vs DISABILITY Vs HANDICAPPED



IMPAIRMENT

- any loss or abnormality of physiological, psychological or anatomical structure or function.



DISABILITY

 - any restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being.



HANDICAPPED

 a disadvantage for a given individual resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal for that individual

TERTIARY PREVENTION

Phase of disease: Late stage of diseaseGoal: Reduce number/impact of complicationsTarget population: Those who have disease and need treatment.

Typical activities:

- Treatment tailored to the patient
- Rehabilitation to promote recovery

Rehabilitation

The combined and coordinated use of medical, social, educational and vocational measures for training and retraining the individual to the **highest possible level of functional ability.**

- 1. Restoration of Function
- 2. Restoration of Personal Dignity and Confidence
- 3. Restoration of the Capacity to earn a livelihood
- 4. Restoration of Family and Social Relationship



Caries prevention: how far it had come in one century!

- the goal in the early days of dentistry more than a century ago when Dr. G.V. Black proposed the "Extension for Prevention" concept during the restoration of teeth
- As dental decay rates began to fall worldwide in industrialized countries after Second World War, a new concept of operative dentistry began to take hold. It is called Minimal Intervention Dentistry (MID),

 early intervention minimizes tooth destruction because the disease is diagnosed prior to cavitation, and steps are taken to remineralize the enamel and arrest the decay. However, more than that assessing caries risk can be done in several ways using many different approaches include:

- analysis of patient history (social, medical, and dental)
- > a careful extra- and intraoral examination
- Changing dietary patterns,
- controlling the cariogenicity of the oral microflora,
- and providing a healthy environment for remineralization are primary goals of MID

THANK YOU







Fluoride side effect L.Khawla.M.Saleh

Preventive dentistry

functions of fluoride



Method of Varnish Application

1. Oral prophylaxis is done.

2. Teeth are dried and but not isolated with cotton rolls as varnish sticks to cotton.

3. First lower arch is taken up for application and then upper arch as saliva collects rapidly on the lower arch.

4. Dispense a small amount of varnish (0.3 ml to 0.5 ml, or 2 drops, for the entire primary dentition) to the applicator dish or pad





5. Application is done with single tufted brush starting with proximal surfaces (Dental floss can be used to ensure that the varnish reaches interproximal areas).

6. Since varnish sets rapidly when they come in contact with

saliva, no drying is necessary.

7. After application, patient is made to sit with mouth open for 4 minutes.

Recommended Dosage

- Fluoride varnish has a high fluoride concentration,
- ✓ but its safety is acceptable.
- Varnish is fast setting, fluoride is slowly released, and a small amount is needed for the complete dentition.
 Measurements of fluoride after topical treatments with varnish. show levels far below those considered toxic.
- ✓ Consequently, varnishes may be a better alternative to fluoride gels, especially for young children.

✓ The only disadvantage of sodium fluoride varnishes is that they cause a temporary change in tooth color, which dental professionals need to inform their patients of.

Indications:

Fluoride varnishes are used for:

- Disabled children
- Incipient caries lesion
- After restorative treatment is complete under general anesthesia
- Very young children who cannot expectorate the gel.

Fluoride varnishes are safe because the amount of varnish usually used is 0.3-0.5 ml which delivers only 3-6 mg of fluoride.

Note: Patient is advised not to eat or brush for at least 4 hrs. after varnish application.





E. Restorative Materials Containing Fluoride

- The purpose of adding fluoride to restorative material is to capture its anticariogenic property
- A major reason for the failure of restorations is recurrent or secondary caries, incorporation of fluoride into restorations may be beneficial because of the observed cariostatic action of fluoride.
- ► The fluoride ions are slowly released from the materials.
- Fluoride has also been added to amalgam in an attempt to reduce the risk of recurrent caries at restoration margins.

Fluoride containing restorative materials includes

- glass ionomer cements,
- resin modified glass ionomer cements
- ▶ , polyacid modified resin composites (compomers),
- ▶ resin composites, fissure sealants and dental amalgam.
- Fluoride releasing components have included;
- fluoroaluminosilicate glasses (FAG),
 stannous fluoride (SnF2),
 organic amine fluorides (CAFH)
 ytterbium fluoride (YbF).



F. Fluoride Containing Devices (Slow Release):

- Considering that intraoral levels of F play a key role in the dynamics of dental caries, it has been suggested that the use of controlled and sustained delivery systems can be considered as a mean of controlling dental caries incidence in high-risk individuals
- ► There are three types of slow-release F devices:
- The copolymer membrane type, developed in the United States
- ► The glass bead, developed in the United Kingdom.
- More recently, a third type, which consists in
 - a mixture of sodium fluoride (NaF) and hydroxyapatite



Fluoride Mouth rinses

- Frequent use of low concentration of fluoride is more cariostatic than less frequent use of higher concentration of fluoride for topical application.
- In areas where water fluoridation is not possible or has not been implemented, the fluoride mouthrinses have been found to be an effective tool in prevention of dental caries.



- Over the past few decades fluoride mouthrinsing has become one of the most widely used caries-preventive public health measure.
- Sodium fluoride mouth rinse is now widely used in school based programs as well as by individuals at home.
- Other less extensively tested fluoride mouth rinses include those containing APF, stannous fluoride, ammonium fluoride and amine fluoride. Caries reduction by 30 %.

Recommendations

- Mouth rinses designed to be rinsed and spit out, either prescribed by the dentist.
- The American Dental Association recommends the use of fluoride mouthrinses, but not for children under six years of age because they may swallow the rinse.
- In communities with fluoridated water supplies or with natural occurring optimum fluoride level in drinking water, mouth rinsing programs would give a super added benefit.
- Over-the-counter daily fluoride mouthrinses generally contain 0.05 % NaF (200–220 ppm F). A 10 mL volume should be swished around the mouth vigorously once each day for one minute (ideally just before bedtime) and then expectorated. Patients should not rinse afterwards for 30 minutes. Pharmacy-only "weekly fortnightly" fluoride mouthrinses typically contain 0.2 percent NaF (900 ppm F). They are designed to be used under adult supervision, once each week for one minute.
- Fluoride mouthrinse should be used at a time of day when toothpaste is not used, and it should not be a substitute for brushing with fluoridated toothpaste. After rinsing, mouthrinse should be spat out, not swallowed

Indection

- 1. Patient with low salivation and high caries level because of systemic disease, use medication, surgery, radiotherapy.
- Patient wearing orthodontic appliance which act as traps for plaque accumulation.
- ▶ 3. Patient unable to achieve good oral hygiene.
- A. Patient with gingival gum recession and susceptible to root caries.
- ▶ 5. Patient with rampant caries.

Fluoride Toxicity

Ingestion of fluoride in excessive quantities can be toxic. The fluoride toxicity can be *chronic* or *acute*.

Chronic fluoride toxicity refers to long term ingestion of fluoride in amounts that exceed the approved therapeutic level.

Acute fluoride toxicity: Acute means rapid intake of an excess dose over a short period time.
Factors affecting fluoride toxicity:

The differences in toxic potential of different fluoride compounds are related to:

1. Solubility of the compound.

2. Content of the compound, e.g. stannous fluoride is slightly more toxic than sodium fluoride because high doses of tin ion.

3. route of administration

4. Age.

- 5. Rate of absorption.
- 6. Acid-base status.

1. Acute toxicity.

- Acute fluoride poisoning is rarely seen. Symptoms of acute fluoride poisoning
- ▶ 1. Salivation
- ▶ 2. Nausea
- ▶ 3. Vomiting
- 4. Abdominal pain
- ▶ 5. Diarrhea
- ► 6. Cramps
- ▶ 7. Cardiac arrhythmia
- ▶ 8. Coma

Management of fluoride acute toxicity:

- Management based on the amount of fluoride ions ingested if < 5.0 mg/kg,
- Initial Emergency Response in the Oral Care Setting:
- I. Induce vomiting by administering an emetic, to reduce the fluoride absorption (this should occur only if the client has a gag ref is conscious, and is not convulsing)
- This is followed by the oral administration of 1% calcium chloride or calcium gluconate; if these are not available milk should be ingested.
- 3. Increasing fluoride excretion by increasing the alkalinity of the urine and fluid replacement.

If fluoride ingested level >5.0 mg/kg need induce vomiting ingested Milk, and 5% calcium gluconate, hospitalization

Lethal and Safe doses of Fluoride

- Certainly Lethal Dose (CLD)
- A lethal dose is the amount of drug likely to cause death if timely interception by antidote is not initiated.
- ► *In Adult*: CLD is 5–10 gm of sodium fluoride taken at 1 time.
- ▶ The fluoride ion equivalent is 32–64 mg Fluoride (F) per kg body weight.
- In Children: CLD is approximately 0.5–1.0 gm. It varies with size and weight of the child. children under 6 years of age, however 500 mg is lethal

probably toxic dose (PTD). The minimum dose that could cause toxic signs and symptoms, including <u>death</u>, and that should trigger immediate therapeutic intervention and hospitalization for fluoride intoxication has been set at 5 mg/kg body weight this is called probably toxic dose (PTD).

Recommendations for parents about use of fluoride agent by children

- Parental supervision
- Child-proof containers (for fluoride tablets)
- Keep products out of reach of young children
- Supervise children when brushing / rinsing , Small amount of tooth paste to be used
- Products with low fluoride level to be used
- Teaching children not to swallow paste or rinse
- Strict adherence to professional advice

- 2. Thronic forsicity orosis arising due to excessive intake of fluoride over a prolonged period of time.
- It can cause dental and skeletal changes referred to as dental and skeletal fluorosis respectively.

Dental fluorosis

- It is a hypoplasia or hypomineralization of tooth enamel or dentine produced by chronic ingestion of excessive amount of F during the period when teeth are developing. In relation to the stage of tooth development and exposure to fluoride.
- The central incisor takes approximately 3 years to go through complete enamel mineralization





Skeletal Fluorosis





- Skeletal fluorosis affects the bones/skeleton of the b
- Skeletal fluorosis affects children as well as adults.
- ► It does not easily manifest until the disease attains an advanced stage.
- Fluoride mainly gets deposited in the joints of neck, knee, pelvic and shoulder bones and makes it difficult to move or walk.
- The symptoms of skeletal fluorosis are similar to spondylitis or arthritis. patients children as well as adults. It does not easily manifest until the disease attains an advanced stage.
- Patients who consume large quantities of water or who have renal problems should avoid fluoridated water

Physicians should at least consider that some joint pain complaints may simply be the result of exposure to too much fluoride and develop a strategy to reduce the fluoride intake











A. Communal water Artificial Fluoridation

- Fluoridation is the controlled adjustment of a fluoride compound to a public water supply in order to bring the fluoride concentration up to a level which effectively prevents caries.
- The studies of Dean and others up to 1943; shown that fluoride was associated with a lower prevalence of caries, and that there was a sound basis for hypothesis that the introduction of fluoride into a water supply would result in a lower communal prevalence of caries.

 Water fluoridation requires a level of dental caries in the community that is high or moderate, or a firm indication that the caries level is increasing

History of water Fluoridation

Dean's results showed that both a reduction of dental caries and an acceptable level of enamel fluorosis could be attained with water containing fluoride levels at approximately 1 ppm of fluoride.

Systemic Fluoride

is ingested.

- ▶ In1945 Grand Rapids, Michigan city, became the first city in the world to fluoridate its drinking water as a measure to promote dental health and prevent disease. Grand Rapids was the test, or intervention, city and Muskegon, Michigan, whose water was not fluoridated, as control in USA.
- The previous year(1944) a baseline study comparing Grand Rapids with the neighboring town of Muskegon had found similar decay levels in deciduous and permanent teeth in both areas. Six years later, surveys indicated that decay levels in 6-year-old children (i.e. those born since fluoridation commenced) in Grand Rapids was almost half of that of Muskegon, in 'non-fluoride' Muskegon the average number of teeth with decay experience was 5.7, compared with 3.0 in 'fluoridated' Grand Rapids .

Artificial water fluoridation level

World Health Organization (1984) guidelines suggested that the level of artificial water fluoride according to climate as:

- In areas with a warm climate, the optimal fluoride concentration in drinking water should remain below 1 mg/ liter (1 ppm or part per million).
- 2. While in cooler climates it could go up to 1.2 mg/liter. (A range of 0.7-1.2 ppm). The differentiation derives from the fact that perspiration is more in hot weather and consequently intake is more.



Advantages of water fluoridation:

- ▶ 1. Low cost.
- > 2. No motivation or behavioral changes necessary.
- ▶ 3. Had pre and post eruptive benefit.
- 4. Caries reduction 50-60% in permanent teeth, and 40-50% in primary teeth. And the disadvantage is the possibility of mild to moderate fluorosis

Disadvantages of water fluoridation

- 1. Political and/or emotional objections to water additives.
- 2. Possibility of mild to moderate fluorosis if other sources of fluoride are ingested
- ▶ 3. Alleged toxicity.

Systemic effect of fluoride:

- I. Pre-eruptive Systemic Effects: During tooth development, fluoride is incorporated into the developing tooth's mineralized structure.
- the presence of fluoride in the dental enamel probably increases resistance to demineralization when the tooth surface is exposed to organic acids

Systemic fluoride may enhance the resistance of the tooth by way of:

- ▶ 1. An alteration in tooth morphology, and
- 2. A conversion of the hydroxyapatite mineral to a fluoridated state with an attendant reduction in solubility and an enhancement of the remineralization phase of the caries process.

2. Post-eruptive Systemic Effects:

- After tooth eruption, fluoride is no longer involved systemically in tooth formation. However, consumed fluoride is excreted through the saliva and can aid in tooth protection throughout the lifetime
- At the time of tooth eruption the enamel is not completely calcified and undergoes a post-eruptive period of approximately 2 years during which enamel aid in tooth protection throughout the lifetime. calcification continues.
- Throughout this period-period of enamel maturation' there is continuous accumulation of fluoride as well as other elements in the superficial part of enamel

Fluoride compound used in water fluoridation

- ▶ 1. Fluorspar: It is a mineral containing calcium fluoride [CaF2].
- **2.** Sodium fluoride.
- ▶ 3. Silicofluorides.
- ▶ 4. Sodium silicofluorides: Most commonly used due to its low
- cost. Solutions of this compound are corrosive hence
- ▶ materials for piping, etc. should be chosen accordingly.
- **5.** Hydrofluosilicic acid.
- ▶ 6. Ammonium silicofluoride [(NH)2SiF6].

Medical aspect of Water Fluoridation

- According to World Health Organization's monograph 'fluoride and human health' there is evidence that
- ▶ WHO. None has found evidence that drinking water with a concentration of around 1 ppm is harmful to health.
- In fact other than dental fluorosis only endemic skeletal fluorosis is known to result from long-term ingestion of water containing high levels of fluoride. ngestion of fluoride at recommended levels presents no danger to humans
- Fluoridation is the adjustment of water supply to a fluoride content such that reductions of 50 to 70 % in dental caries would occur without damage to teeth or other structures.

In recent years opponents of fluoridation have attempted to link fluoridation with a wide range of diseases, e.g. cancer, Alzheimer diseases or that it interferes with the immune function. But there is overwhelming agreement between the scientific, medical and dental community worldwide that fluoridation of water is a safe and effective public health measure.

B. School Water Fluoridation

An alternative to community water fluoridation is the fluoridation of school drinking water. It's most applicable in rural schools, where fluoridation of community water is not feasible. Reduction in dental caries was found to be about 40 per

Advantages

- 1. There has been around 35 to 40 % decrease in dental caries with this program
- 2. good results in reducing caries.
- 3. Minimal equipment.
- 4.Not expensive/person/year \$ 1.5
- 5. Safe
- 6. Accepted by child
- 7. Technically feasible
- 8. No effort required by children

Disadvantages

- The children do not receive the benefits until they begin school [belated exposure]
- Children consume the fluoridated water only when the school is in session [abbreviated exposure].
- ▶ To compensate for this belated and abbreviated exposure,
- the school water is usually fluoridated at 4.5 times the optimum concentration recommended for that place

There are two major concerns about school water fluoridation

- 1. By age 6 all teeth expect 3rd molars are in an advanced stage of mineralization, thus reducing the preeruptive benefits of fluoride.
- 2. There are no data to indicate expected caries incidence following graduation.



Salt fluoridation is a controlled addition of fluoride ,usually sodium or potassium fluoride ,during the manufacture of salt for human consumption.

HISTORY

- ▶ First fluoridated salt was introduce in Switzerland since 1955.
- Experiments have been conducted with concentration of fluoride in salt ranging from 90 mg /kg to 200 -350 mg/kg.
- Initial clinical clinical trial of 90 mg/kg fluoride salt showed 20- 25 % of reduction of dental caries.
- In 1967 Muhleman showed the safe dose of fluoridated salt, that 300 mg/kg yields 1.5 mg fluoride/5 gm of salt. Tooth from Hungary, after 8 years of salt fluoridates at the level of 250 mg fluoride /kg reported 35-58% of caries reduction

ADVANTAGES

- ► Fluoridated salt is safe.
- Theoretically fluoridated salt prevents dental caries by both systemic as well topical action.
- ▶ It does not require community water supply as in case of water fluoridation.
- ▶ It permits individual to accept it or reject it.
- Low cost
- ▶ Fluoridated salt and iodized salt can be made available to the population.

DISADVANTAGES

- No precise control over indicated consumption, since salt intake varies greatly among people
- ▶ Infants do not start administration from birth.
- ▶ Less sodium (Na) intake to help control hypertension.

MILK FLUORIDATION

- > The nutritional value of milk has been well documented .
- Milk is often available to children through school and nutritional programs and the use of such distribution systems can provide a convenient and cost efficient vehicle.
- Virtually all forms of milk products are suitable for fluoridation and the process is relatively simple.
- Milk fluoridation can be targeted at those communities in greatest need.



COMPOUNDS USED FOR MILK FLUORIDATION

- Calcium fluoride
- Sodium fluoride

Г

- Disodium monofluorophosphate
- Disodium silicofluoride

Table (1): Effect of fluoride in wa consumed for longer durations	ter on human health when	
Fluoride concentration (mg/L)	Effects	
<1.0	Safe limit	
1.0-3.0	Dental Fluorosis	
3.0-4.0	Brittle and stiff bones and joints	
4.0–10	Dental fluorosis, skeletal fluorosis	
	(pain in neck bones and back)	





TOPICAL FLUORIDE—2ND.PART

I. Khawla.M.Saleh



Professionally Applied Fluorides Applied by Dentist

A. Aqueous solutions:

Sodium fluoride - 2 % Stannous fluoride - 8%

B. Fluoride Gels

Acidulated phosphate fluoride - 1.23 %

C. Fluoride varnishes (Duraphat, Fluorprotector)

- D. Fluoride prophylactic paste
- E. Restorative materials containing fluoride (composite resin)
- F. Fluoride containing devices (slow release)

Self Applied Fluoride

A. Fluoride dentifrices B. Fluoride mouth rinses C. Fluoride gels

Topical Fluoride Admistration Could Be Applied Through

- 1. Those applied by professional.
- a. Topical solutions and gels.
- b. Fluoride containing varnishes.
- c. Fluoride prophylaxis paste.
- d. Restorative materials containing fluoride.
- e. Fluoride containing devices (Slow Release).
- 2. Self applied fluoride agents.
- a. Fluoride dentifrices.
- b. Fluoride rinses.
- c. Fluoride gels.





Range Of Therapeutic Fluoride Concentrations Used To Prevent Caries Method/Vehicle Fluoride Concentration (Ppm F)

Fluoridated salt \rightarrow 200–250 ppm fluoride Dentifrices, children \rightarrow 250–500 ppm fluoride Dentifrices, adult Twice daily \rightarrow 1,000–1,500 ppm fluoride Fluoridated water 1 \rightarrow Several/day

Indications For Use Of Professionally Applied Topical Fluorides

1. Patients who are at high risk for caries on smooth tooth surfaces and on root surfaces

- 2. To reduce tooth sensitivity
- 3. White spots
- 4. Active decay
- 5. Special patient groups, such as:
- i. Orthodontic patients
- ii. Patients undergoing head and neck irradiation
- iii. Patients with decreased salivary flow
- 6. Additional protection if necessary for children in areas without fluoridated

drinking water

STANNOUS FLUORIDE (SNF2)

- The recommended concentration 8% SnF2 is used
- 19,500 ppm of available fluoride and 32% effective in caries reduction

(Muhler's Technique)

Available in powder form either in bulk containers or preweighed capsules.

Method Of Preparation

The solution has to be freshly prepared as they are unstable. It can be prepared by dissolving 0.8 gm of powder in 10 ml of distilled water. The solution is acidic, with a pH of 2.8. The left over solution should be discarded after application.

Recommended Schedule; A six monthly interval treatment schedule is advised.

Mechanism Of Action

Stannous fluoride reacts with hydroxy apatite and in addition to fluoride the Tin of solution also reacts with enamel and form **Stannous tri-fluorophosphate**, which is more resistant to carious attack.

SnF2 has produced significantly greater caries reduction than sodium fluoride.

Advantages of Stannous Fluoride (SnF2)

1. Rapid penetration of fluoride to the deeper layer of enamel.

2. Highly **insoluble tin fluorophosphates complex** form on the enamel surface that acts as a **protective layer** for the enamel decay.

Disadvantages of Stannous Fluoride (SnF2)

1. Unstable in aqueous solution and undergoes rapid oxidation so should be prepared fresh for each patient.

2. It is highly acidic in nature (pH 2.1-2.3)

3. It has metallic taste which is unacceptable to most of the children and patient

4. It may cause gingival irritation particularly to dehydrated and diseased gingival tissues.

5. SnF2 produces discoloration of hypocalcified area of teeth.

6. It will produce staining on the margins of the restorations

B. FLUORIDE GELS

Fluoride gels and foams contain a high concentration of fluoride, typically up to 12.3 mg fluoride.

Acidulated Phosphate Fluoride: 1.23% is used

- 12,300 ppm of available fluoride, 4min;2/yr
- 3.0 pH
- 22% effective in caries reduction

Brudevolds Solution: is available as either as a solution or gel. Both are stable.



METHOD OF PREPARATION:

Solution: is prepared by dissolving 20 gms of **sodium fluoride** in 1 liter of 0.1 M **phosphoric acid**. To this is added 50 percent **hydrofluoric acid** to maintain a pH of 3.0 and fluoride ion concentration at 1.23 percent.

Gel: for preparation of gel [APF], a **gelling agent methylcellulose** or **hydroxyethyl cellulose** is added to the solution and the pH is adjusted 4-5.

Recommended frequency of APF application is twice a year topically.

MECHANISM OF ACTION

APF when applied on teeth initially leads to dehydration and shrinkage in the volume of hydroxyapatite crystals.

There is further hydrolysis and formation of dicalcium phosphate dehydrate (DCPD), which is highly reactive The fluoride ions start penetrating into the deeper crystalline structure of enamel and forms fluorapatite which is stronger to acid dissolution.

ADVANTAGES

- 1. It is stable when stored in a plastic container.
- 2. No staining of teeth.
- 3. Gels can self-applied.
- 4. Cheap

DISADVANTAGES

1. Cannot be stored in glass container because it may remove minerals from the glass [etch].

2. Repeated exposure of porcelain or composite restorations to APF can lead to loss

of material leading to surface roughening and cosmetic changes hence not advisable to use acidic topical fluoride agent in patients with these type of

restorations.

- 3. It has an acidic taste.
- 4. Repeated application necessitates the use of suction

Procedure For The Application Of Fluoride Solution

a. Oral prophylaxis to done.

b. Teeth are isolated with cotton rolls and dried with compressed air.

c. Fluoride solution to then applied continuously with cotton applicator so as to keep teeth moist with fluoride solution for 4 minutes.

d. After all the teeth are treated patient to asked to expectorate and instructed not to rinse, drink or eat for next half hour

Procedure For The Application Of Fluoride Gel

1. Mouth trays should be tried in the patient's mouth It may be necessary to adapt or trim trays

2. Patient should be seated upright and suction should be used during the procedure.

3. Teeth should be air-dried before gel application , cleaning or prophylaxis is unnecessary prior to APF.

4. Enough gel, or foam, should be used to completely cover the teeth, but should be no more than 2-2.5 grams per tray or 40 percent of the tray's volume.

5. Fluoride should be applied for 4 minutes.

6. Patient should not rinse, eat, or drink for at least 30 minutes after the procedure.

Note: For patients with porcelain or resin restorations, *neutral sodium fluoride* is recommended to prevent etching of restorations.

C. Fluoride Varnishes

(ex. Duraphat)

Fluoridated varnishes were introduced into the market in the 1960s, and are intended for professional application only.

The main **advantages** of varnishes are:

1) the prolonged contact time between fluoride and the tooth

surfaces (increases fluoride uptake by dental hard tissues,

as well as the formation of CaF2 reservoirs),

2) the possibility of using very small amounts of the product

(a thin layer), which minimizes the risk of excessive fluoride ingestion.



3) Despite having higher fluoride concentrations, varnishes can be regarded as a safer option when compared to gels, due to the small amount used during application.

In order to achieve the maximum benefits for caries prevention, varnishes must be applied 2–4 times/year, depending on caries risk considerations.

Table: Comparative effectiveness of professionally applied topicalfluoride agentsAgentFluoride Conc.Average effectivenest

Agent	<i>Fluoride</i> Conc. (ppm F)	Average effectiveness % caries reduction
2% NaF	9.200	29
APF (1.23% F)	12.300	22
8% SnF ₂	19.500	32
Fluoride varnish (5% NaF)	22,600	38

D. Fluoride Prophylactic Paste

The major functions of prophylactic paste are:

1. To clean the tooth surface through the removal of all exogenous deposits.

2. Polish the dental hard tissues, including restorations.

Prophylactic paste contains abrasive particles which abrade the deposits and debris from tooth surface. Now a days **APF-silicone dioxide paste and SnF2 - Zirconium silicate p**aste are also available.

Studies have shown that their use alone cannot be considered as an effective cariostatic method.

A thorough polishing may remove a thin, but highly mineralized outer layer of enamel. If prophylaxis is required for periodontal reason, cosmetic reasons then fluoride prophylactic past recommended, as it may help replenish the minerals that abraded during polishing. They may have a modest carious effect.
1. FLUORIDE DENTIFRICES

adding fluoride to tooth-paste has been carried out since 1945 and covers a wide range of active ingredients in various abrasive formulations.

Compounds that have been tested for caries-inhibitory properties include sodium fluoride, acidulated phosphate fluoride, stannous fluoride, sodium monofluorophosphate and amine fluoride.

Most toothpaste nowadays contain **sodium fluoride or sodium monofluorophosphate** as active ingredient, usually in concentration of 1000–1100 mg F/g.



Fluoridated Toothpaste For Children

✓ Concern about the fluorosis risk from children swallowing toothpaste has led to trial of lower-strength dentifrices. Findings from studies of 500-550 m gF/g products suggest efficacy equivalent to 1000 mgF/g toothpaste.

 \checkmark Since children can swallow between 0.12 and 0.38 mg of toothpaste per brushing, lower fluoride toothpaste may reduce the risk of fluorosis while substantially retaining the caries preventive benefits.

 \checkmark The production of candy like flavors and toothpaste containing fluoride at 1500 ppm or more should not be encouraged for use by children, as it may lead to an excessive ingestion of fluoride.

TOOTHPASTE FORMULATIONS

Most 1000 ppm fluoride containing toothpaste achieve this concentration, i.e. [0.1%F=1 mgF/g paste] by adding one of the following fluoride salts.

• Sodium fluoride [0.2% NaF]

□ Sodium monofluorophosphate [0.76% Na2PO3F]

• Stannous fluoride [0.4% SnF2]

Stannous Fluoride toothpaste has one major disadvantage that they lead to unsightly black/ brown extrinsic staining of tooth surface, specially around margins of tooth colored restorations. The discoloration is probably due to precipitation on the acquired pellicle of oxides and sulphides of tin.

Both sodium fluoride and sodium monofluorophosphate

dentifrices can be recommended freely as available evidence fails to support the superiority of one fluoride over the other.

A unique characteristic of sodium *monofluorophosphate* is its compatibility with a wide variety of dentifrice abrasive system.

In contrast to other fluoride compounds such as stannous fluoride, which are almost completely dissociated in aqueous solution to yield fluoride ions that readily react with available cations, Fluoride in toothpaste is taken up directly by demineralized enamel and it also increases the fluoride concentration in dental plaque, thus leaving a store of fluoride available for remineralization when pH drops.

Manner Of Use Of Fluoridated Toothpaste

• Fluoridated toothpaste should be used daily for tooth cleaning by person of all ages to control development and progression of dental caries.

• In children under the age of 6 years, brushing should be supervised in order to prevent excessive ingestion.

• In children only a very small amount (less than 5 mm) which approximates the "pea size" should be placed on the brush.



Mechanisms Of Fluoride Action:

1. Increased enamel resistance or reducing enamel solubility [acid dissolution].

2. Interferes in the formation and functioning of dental plaque microorganisms.

3. Increases the rate of post-eruptive maturation.

4. Remineralization of incipient lesions.

5. Improves tooth morphology

The presence of elevated concentration of fluoride in enamel surface makes tooth surface more resistant to development of dental caries.

Fluoride ions when substituted into the hydroxyapatite crystals fit more perfectly than do hydroxyl ions.

The greater bonding potential of fluoride makes the apatite crystals more compact and more stable, thereby more resistant to the acid dissolution.

When concentrated topical fluoride agent reacts with enamel there is formation of calcium fluoride:

Most topical fluoride agents have a fluoride ion concentration of between 10,000–20,000 ppm which leads to the formation of calcium fluoride and eventually **Fluorhydroxyapatite** $Calo [PO4]6[OH] 2 + 20F- \leftrightarrow \Box 10 CaF2 + 6[HPO4-] 3 + 2[OH]-Hydroxyapatite Calcium fluoride$





Fluoride's Effect On Tooth Mineral:

Fluoride, however, substituting for the hydroxyl group fits extremely well and stabilizes the hydroxyapatite (HA) molecule forming fluoridated apatite fluorapatite (FA). If all of the hydroxyl ions are substituted fluorapatite (FA) forms.

The fluoride ion is extremely electronegative and forms very strong hydrogen bonds with hydroxyl and acid phosphate groups in the HA crystal rendering the enamel surface more difficult to

protonate. Essentially this makes the enamel more difficult to demineralize, and it also favors the remineralization process.



Fluoridated apatite and/or fluorapatite are generally found in the surface layers of enamel that contains high fluoride concentrations of fluoride. This can arise both during development and from topical exposure.

1-Decreases the solubility of the crystals pment and from topical exposure. Also the greater bonding potential of fluoride makes the apatite crystals more compact and more stable, thereby more resistant to the acid dissolution.



2- Remineralization

Fluoride enhances remineralization by adsorbing to the crystal surface and attracting calcium ions, followed by phosphate ions,

the saliva flows over the plaque and its components neutralize the acid, raising the pH, demineralization is stopped and reversed. The saliva is supersaturated with calcium and phosphate, which can drive mineral back into the tooth.

These processes constitute remineralization—the replacement of mineral in the partially demineralized regions of the carious lesion of enamel or dentine (including the tooth root).

Fluoride enhances remineralization by adsorbing to the crystal surface and attracting calcium ions, followed by phosphate ions, leading to new mineral formation. FAP contains approximately 30,000 ppm F and has a very low solubility in acid.







The clinical use of laser irradiation is based on a wide range of physical phenomena of light interaction with biological tissues, cells, and fluids.



-LASERS in dentistry

are considered to be a new technology which is being used in clinical dentistry to overcome some of the drawbacks posed by **the conventional dental procedures** and has different applications on soft and hard tissues. .

This technology was the first used for dental application by **Maiman 1960s** but it uses has increased rapidly in the last few decades and nowadays it covers a broad range of procedures, forn diagnosis of caries or cancer to soft tissue and hard tissue another to concert.

LASER BASICS

- Dental LASERS are named depending based on the active medium that is stimulated.
 - The active medium can be
- a gas (e.g. argon, CO2 (carbon dioxide 9300nm or 10600nm),
 - a liquid (dyes) Er:YAG (Erbium 2940nm),
- a solid state crystal rod e.g. Neodymium yttrium aluminum garnet (Nd:YAG), Erbium yttrium aluminum garnet (Er: YAG) Ho:YAG (Holmium Yttrium Aluminum Garnet 2100nm),
- a semiconductor (diode lasers).
- Metal vapor)copper

LASER

Dentistry



- Laser emission modes play an important role in increasing the tissues temperature.
- The thermal effect of laser energy on tissues primarily involves the water content of tissues and the temperature rise of tissues.
- The thermal effects are necessary for clinical procedures such as cutting, coagulation, vaporization, and ablation of biological tissues, and to achieve these, high power lasers are used.
- These lasers increase tissue temperature by 1 °C or more and, in this way, promote coagulation, cutting, vaporization or ablation of tissues.







Laser effects on tissues:



Depending on the optical properties of the tissues, the light energy from a laser may have four different interactions with the target tissues, as follows:

- **Reflection**.
- I Transmission.
- **C** Scattering.
- **Absorption**.



Role of laser in preventive dentistry

- Laser dentistry when combined with conventional preventive dentistry techniques has enhanced the effect of preventive measure.
- Action of preventive techniques likes fluoride applications, pit and fissure sealants etc. have more successful results after combining them with lasers.

Certain roles of laser in prevention of dental caries as follows:

- To prevent dental caries, the energy generated by the lasers must be highly absorbed by the dental substrates and efficiently converted into thermal energy, which is confined to the surface and can modify the structure and chemical composition of these substrates to promote increased acid resistance.
- A greater selectivity of wavelengths in the targeting and removal of the carbonate group from enamel mineral molecule results in a greatly increased acid-resistant compound. Additionally, the altered mineral has greater uptake of topically applied fluoride.



- CO2 laser can be used safely to alter the enamel surface and make it more resistant to caries, without causing dental pulp damage.
- Also enhancing fluoride uptake into the crystalline structure of the tooth in the form of firmly bound fluoride.
- Argon laser: The proposed mechanism for the protective effect of argon laser irradiation against both caries initiation and progression is alteration of the characteristics of the enamel surface by creating microspaces that trap calcium, phosphate, and fluoride ions during an acid challenge.



- Nd:YAG laser:

 Similar mechanisms to those for CO2 lasers have been suggested for Nd:YAG lasers in caries prevention. However, unlike the CO2 laser, which is the most efficiently absorbed laser by dental enamel, the Nd:YAG laser is not effectively absorbed 4 by human enamel. Thus, its efficient use in this substrate depends on the application of a photosensitizer.

Erbium lasers: Er: YAG used in caries prevention as greatly increased acidresistant of enamel
Ruby laser : is less effective in decreasing subsurface demineralization during caries process. The extensive heating generated by this type of laser resulted in structural damage of tooth

Benefits of dental lasers

- The main benefit is the ability to interact selectively and precisely with diseased tissues.
- Reduce the amount of bacteria and other pathogens.
- The cavity preparation by laser has been disinfectant because of the bactericidal nature of laser energy.

Drawbacks of dental lasers

- The disadvantages of dental laser are the relatively high cost and the required training.
- Another drawback of erbium laser is the inability to remove metallic restorations.
- No single wavelength will optimally treat all dental tissues.

3_Laser cavity preparation and caries removal

- the laser that use in cavity preparation with low 'fluences' (energy (mJ)/unit area (cm2).
- Even without water-cooling the prepared cavities showed no cracks and low or no charring while the increase in the mean temperature of the pulp cavity was about 4.3degrees
- Laser assisted cavity preparation
- . Lasers cut at a point of their tipTo be used with up and down motion
 - **Rough edges that need hand instruments such as**
 - excavators to carry away the ablation products
 - **Removes smear layer**

Considered safe in cases of unexpected patient movement



Conventional cavity preparation

- Burs produce abrasive cutting from their sides and are also cut at the end
- Side brushing action is also used along with end cutting Produces smooth edges
- Produces a smear layer
- Considered unsafe in cases of unexpected patient movement

Treatment of dentinal hypersensitivity

- Dentinal hypersensitivity is characterized as a short, sharp pain from exposed dentin that occurs in response to provoking stimuli such as cold, heat, evaporation, tactility, osmosis, or chemicals
- The mechanisms causing the reduction in dentine hypersensitivity after lasing are relatively unknown. Some authors suggest various theories about this subject:



Laser Safety: -



All laser devices have complete instructions on the safe use of the machine.

1 - Appropriate protective eyewear must be worn by the patient and dental team.

- Masks must be of appropriate filtering capacity.









