

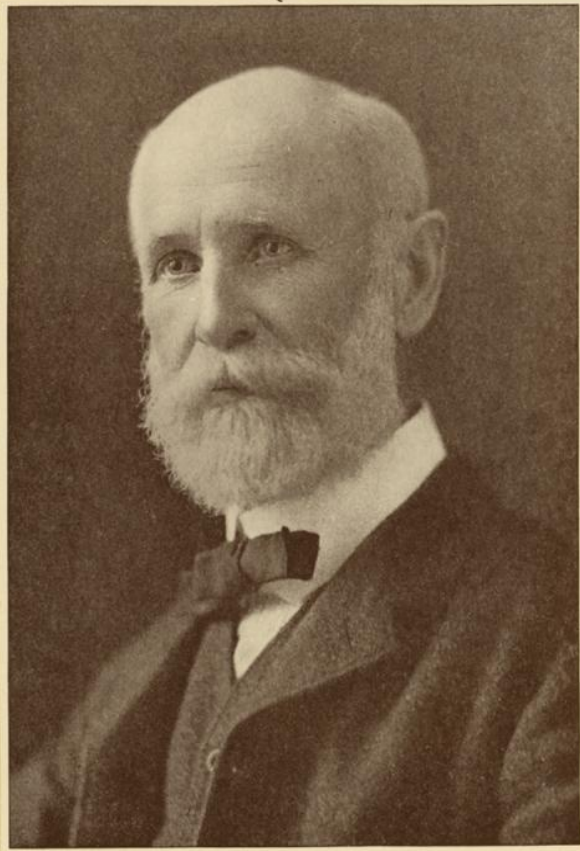
CONSERVATIVE APPROACH AND MINIMAL INTERVENTION

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Introduction

In the past, **extraction** of teeth considered conservatism to avoid spread of caries, then cavity preparation with the concept of **extension for prevention** was adopted as conservative treatment, then conservatism was made to **minimize cutting of tooth structure**. Nowadays, there is a shift to use a **medical model and avoid cutting** if possible.



Greene Vardiman Black

The concept of conservatism in the days of **Greene Vandiman Black**, has changed and remained for many decades.

It involved all measures by which the dentist can **remove caries** and prepare the decayed hard tooth tissue to receive a restoration which involves removal of caries and **extension for prevention**, by extending to self cleansable areas.

Consequences Black's principle of extension for prevention concept:

- 1) Gross weakening of the remaining tooth structures.
- 2) Structural and marginal failure of the restorations.
- 3) Increased the potential for pulpal, gingival and periodontal irritation.
- 4) Increased restorative display
- 5) More time, money and effort.
- 6) Difficult maintenance of the restorative system.

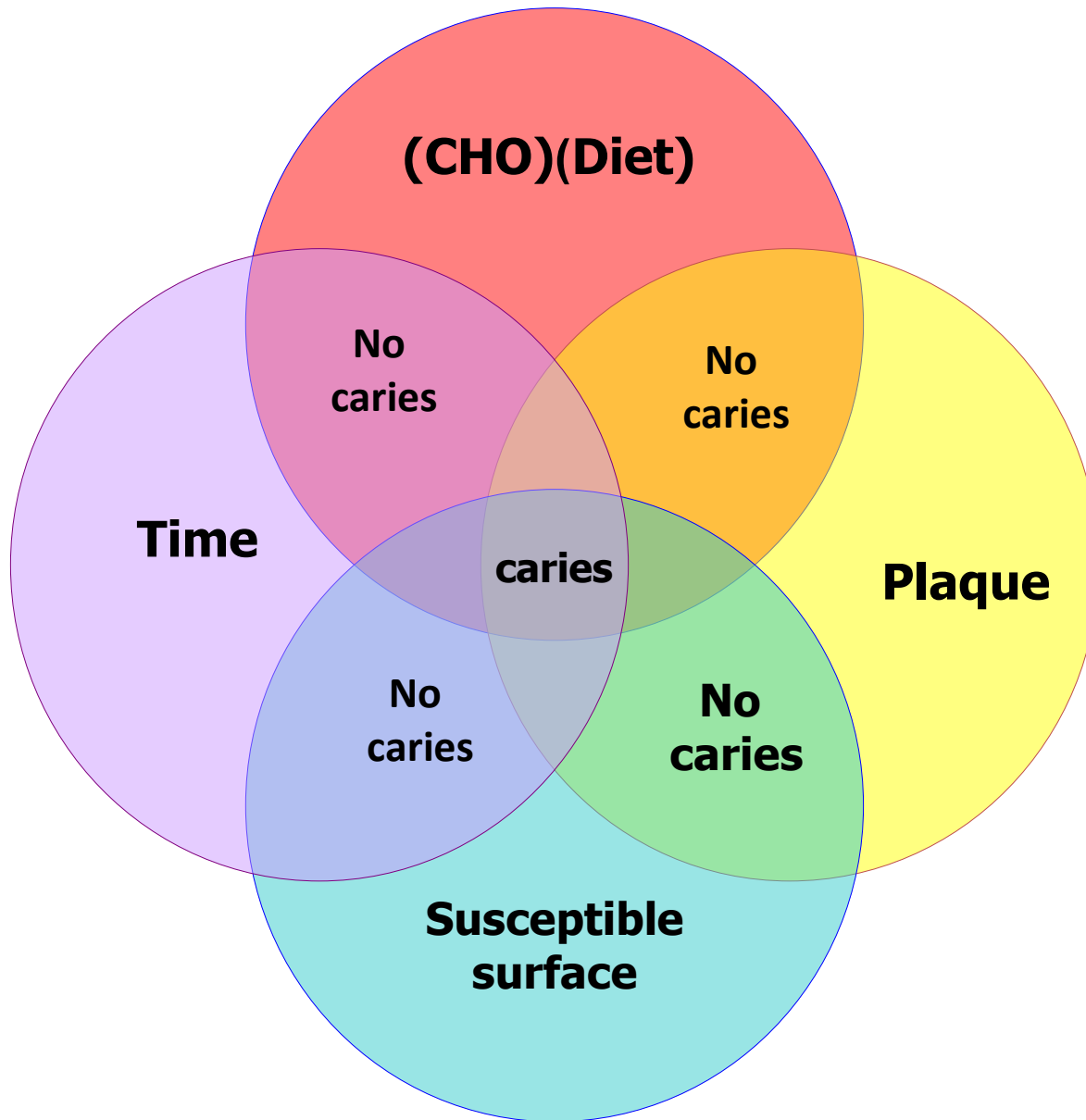
That shift in the concept and approach has resulted from:

- A) Understanding the caries nature and process.
- B) Understanding the sequelae of unnecessary cutting of tooth structure.
- C) The poor physical properties of available restorative materials.
- D) Technological advances in different related aspects.

A) Understanding of caries process:

The caries process was thought to be irreversible sequence of events, beginning with enamel demineralization, followed by protein (collagen) degradation. Thus, the logical treatment was surgical excision.

It is now recognized that enamel and dentin demineralization is not a continuous irreversible process. Rather, there is a **demineralization-reminerlization cycle**, in which the tooth structure alternatively lose and gain calcium and phosphate ions, depending on the microenvironment.



B) Understanding the sequelae of unnecessary cutting of tooth structure

- Increased potential to pulpal irritation.
- Gingival and periodontal irritation due to plaque accumulation on the margins.
- Gross weakening of the remaining tooth.
- Structural and marginal failure of the restoration due to high functional load.
- Increased restorative display and poor esthetics.
- Difficult maintenance of the restorative system.
- More time, money and effort consumption.

C)The poor physical properties of available restorative materials:

- The cavities to be cut should be complying with the properties of the different restorative materials
- Thus, selection of metallic restorative materials that would achieve conservatism becomes imperative and therefore there's a marked trend to shift to direct tooth-colored restoratives .

Bondodontics:

Nowadays, bonding offers a micromechanical level of attachment consisting of numerous resin tags and resin tooth hybrid layer in the top of tooth structure thus minimizing the need for cutting to create retentive features.

Shifting to the conservative approach:

the modern concept of conservation has concentrated on the importance of prevention of disease affecting hard tooth tissue and preservation of the sound tooth structure either by taking the measures to preserve the integrity of teeth from being affected or by minimal intervention just necessary to restore the tooth.

“Prevention rather than extension”

Thus the logic name for our approach:

Minimal invasive approach.

Minimal intervention

Conservative approach.

Minimal intervention concept encompass:

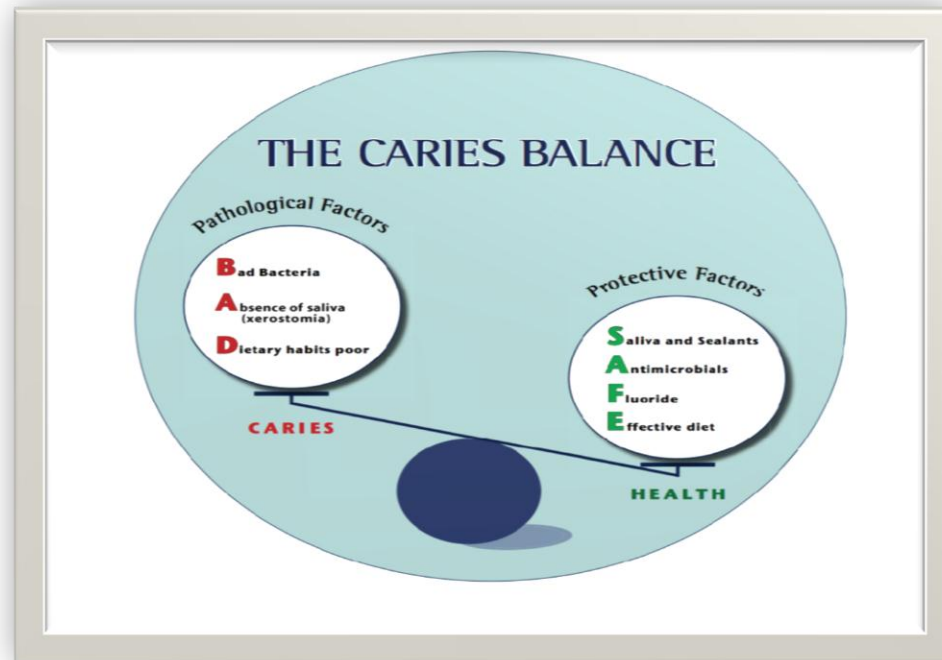
- 1) Oral disease **risk assessment** with early detection of incipient lesion.
- 2) Approaches to prevent and **minimize the demineralization**.
- 3) Approaches to **enhance the remineralization** of non-cavitated lesions.
- 4) **Minimal surgical intervention** for cavitated lesions
- 5) **Repair** rather than replace for defective restorations

Factors essentials to provide conservatism

1. Operator
2. Tools
3. Restorative materials
4. Oral environmental condition
5. Socioeconomic conditions of the patient

Caries Risk Assessment

- Caries risk is the **PROBABILITY** that caries will develop or progress.
- Assessment of caries risk is performed to **predict** if an individual will **develop caries** lesions during a specified **period of time**.



Caries risk assessment has been described as a four processes:

First step:

Identifying the risk factors.

Second step:

Use of risk assessment model as Cariogram model.

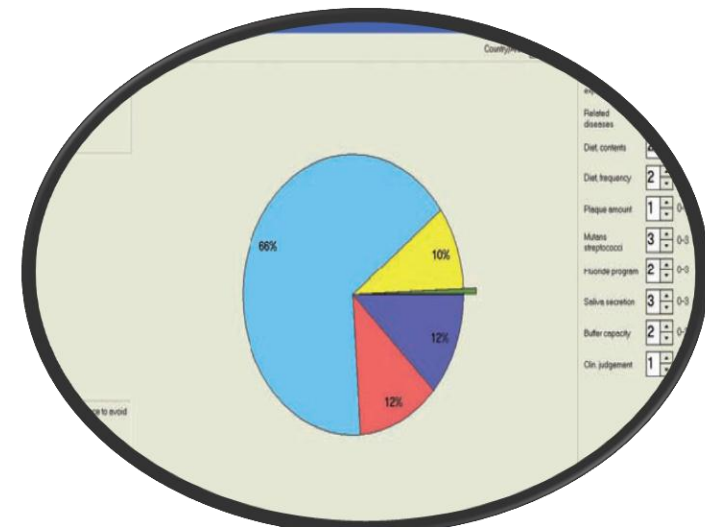
Third step:

It is the assessment process to identify the individuals risk profile.

- 1) No care advise.
- 2) Preventive care advise.
- 3) Operative care advise.

Fourth step:

Selection of the proper line of treatment.



- This is done by :

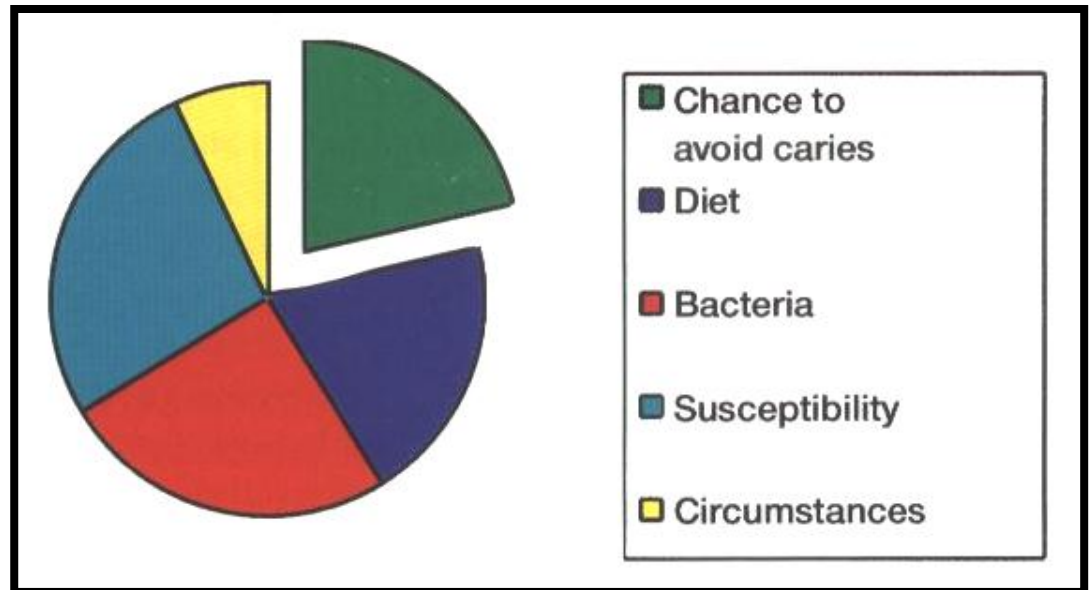
1. DMFT & DMFS Systems
2. Cariogram.
3. ICDAS.
4. Traffic light system.

Caries Risk Assessment

- DMFT and DMFS values are obtained by calculating the number of:
 - (D) decayed.
 - (M) missed.
 - (F) filled:
 - (T) tooth.
 - (S) surfaces.
- e.g. DMFT of 4-3-9 meaning that:
 - 4 teeth are decayed.
 - 3 teeth are missed.
 - 9 teeth are filled.

Cariogram

- It is a computer program that serves as a risk assessment model for each individual.
- It is proposed by “**Bratthal**” in 1996.
- illustrating the interaction between:
 - Bacteria.
 - Diet.
 - Host response.



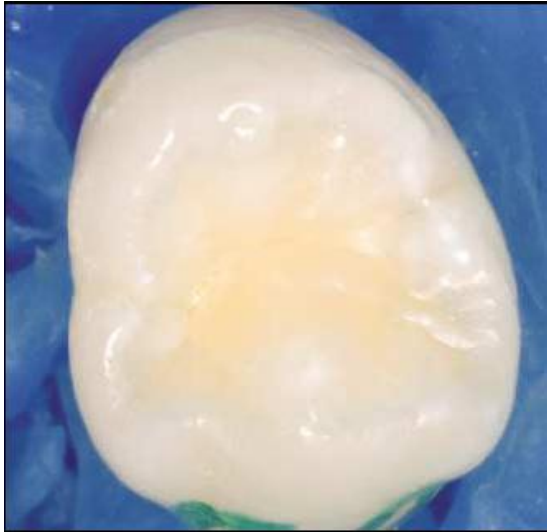
The five sectors involved in the cariogram are:

- **Chance - The Chance to avoid new cavities in the near future.**
- **Diet - frequency of eating as well as contents of diet.**
- **Bacteria - Plaque amount as well as types of bacteria.**
- **Susceptibility - tooth resistance (fluorides) and saliva characteristics.**
- **Circumstances - Past caries experience and general diseases and conditions.**

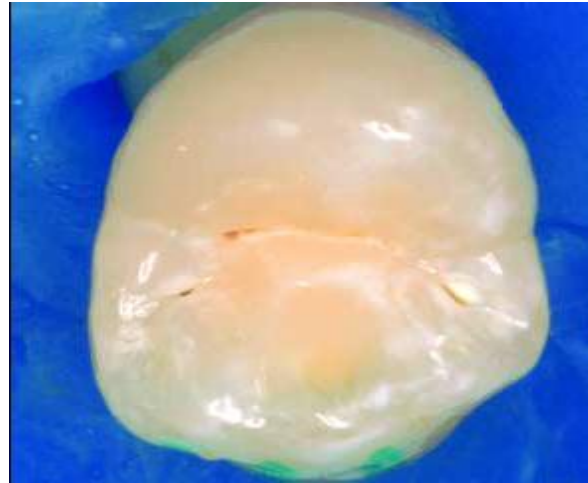
The international caries detection and assessment system (ICDAS)

conducted by the Detroit Center for Research on Oral Health.

- The examiners **visually examine** and classify the carious status of each tooth surface using a seven-point ordinal scale ranging from sound to extensive cavitations.



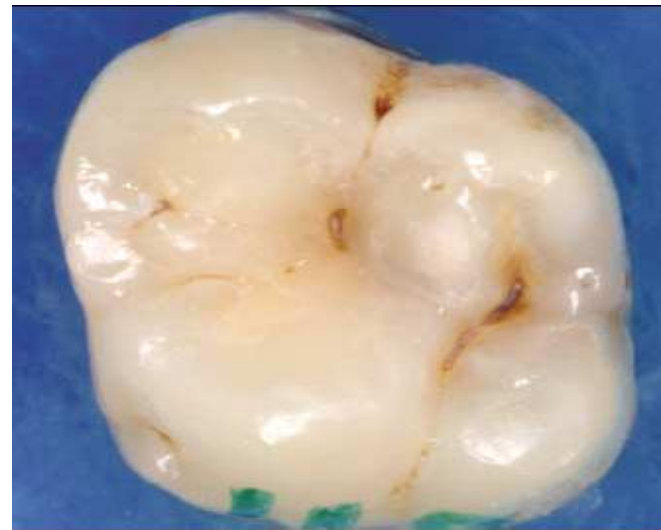
0: Sound tooth surface



1: First visual change in enamel



2: Distinct visual change in enamel.



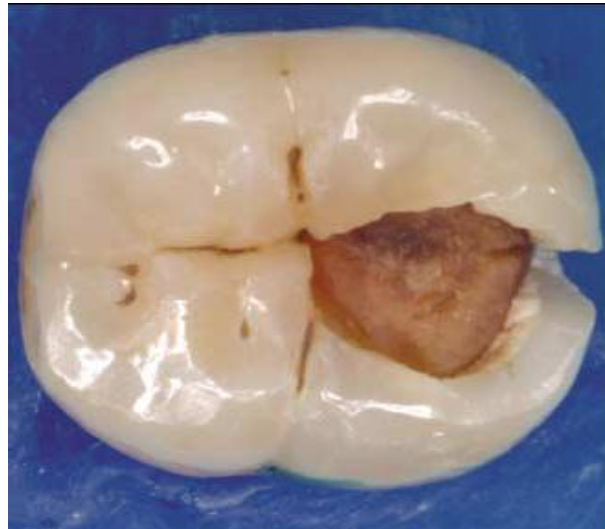
3: Microcavitation.



4: Underlying dark shadow from dentin with or without cavitation.



5: Distinct cavity with visible dentin.



6: Extensive distinct cavity with visible dentin.

Caries Risk Assessment

Diagnostic Tests

Quantity and quality of saliva

- Simulated salivary flow test:
 - Ask the patient to chew **paraffin wax** or gum or use a drop of citric acid on the tongue.
 - Collect the saliva in a small graduated vial over a 2 min. Period.
 - Normal ≥ 0.7 ml/min \geq followed by a further assessment of other risk factors.

✱ **stimulated flow = 1.5-2.5 ml/min.**

✱ **A flow less than 0.7 ml/min = high risk**

Caries Risk Assessment

Diagnostic Tests

Buffering capacity of saliva

- Chair-side method (Dentobuff strip system):
 - One drop of the stimulated saliva is placed on a test strip.
 - The test strip containing acid and pH-indicator.
 - The color of the test bad is compared to a chart, and the final pH is obtained.
 - The method is particularly useful for identifying persons with risk values.
 - Low buffer capacity, final pH of 4 or less.

Caries Risk Assessment

Diagnostic Tests

Microbiological tests

- Determination of streptococcus and lactobacillus count per volume of saliva provides some degree of correlation with risk.
- The result should be considered along with other diagnostic evidences.

Caries Risk Assessment

Diagnostic Tests

Microbiological tests

Strept.Mutans test:

- Chair-side method (Strept Mutans test):
 - It is based on the ability of mutans streptococci to grow on hard surfaces and the use of selective broth medium.
 - The level of mutans streptococci is given as class after comparison with a chart.
 - The level of bacteria indicating low ('0') to high ('3' equiv. To $\geq 10^6$, mutans CFU per ml saliva) number in saliva.

Caries Risk Assessment

Diagnostic Tests

Microbiological tests

Lactobacilli test:

- Chair-side method (Dentocult LB method):
 - The sample is collected and aerobically incubated for 4 days at 37°C.
 - The number of the colonies is estimated by comparing the slide with a model chart supplied by the manufacture.

CAMBRA

Caries MANAGEMENT By Risk Assessment (**CAMBRA**) is an **evidence-based** approach for **preventing or treating** dental caries at the **earliest stages** rather than waiting for irreversible damage to the teeth..

protective factors are biologic or therapeutic measures that can be used to prevent or arrest the pathologic challenges posed by the caries risk factors.

Best practices dictate that once the clinician has identified the patient's caries risk (low, moderate, high or extreme), a therapeutic and/or preventive plan should be implemented.

The caries assessment tool was developed in formats for use by dental providers for patients

- age 0 to 5 and
- patients age 6 through adult.

The assessment tool is composed of the following sections:

1. Caries disease factors (cavities, restorations)
2. Caries risk factors (plaque, saliva)
3. Caries protective factors (fluoride)
4. Caries risk level
5. Bacteria and saliva testing
6. Treatment plan for caries intervention and prevention

Identification of caries:

It was found essential for ultraconservative approach to:

- 1. Utilize magnification**
- 2. Precise diagnostic equipment**
- 3. Non-invasive cutting tools.**

Advanced diagnostic tools to detect incipient lesions:

Magnification Technology:

Loupes: with magnification power 2X-5X

Microscopes: with magnification power 10X-25X



Evaluation of different diagnostic tools of initial carious lesions:

1. Mirror and probe:

- **It is recommended that a blunt explorer (probe) be used very lightly, on the side rather than the point.**
- **The clinician can best assess occlusal fissures by washing and drying them vigorously with warm air and examining them visually with magnification**

2. Radiographs:

- Traditional bite wing radiographs are still mandatory as a diagnostic aid for the caries active patients.
- In order to assess radiographic changes in approximal radiolucencies, a suitable classification is as follows:

E1 = Outer half of enamel.

E2 = Inner half of enamel.

D1 = Outer third of dentin.

D2 = Middle third of dentin.

D3 = Inner third of dentin.

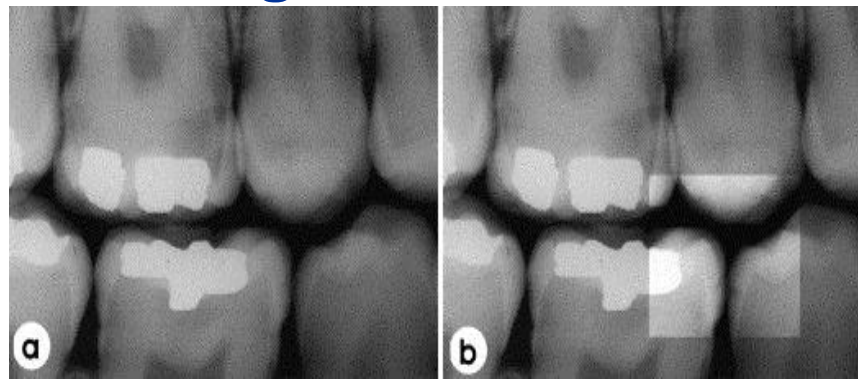
- A tooth or surface with no carious lesion is designated "**Eo**".
- Using the minimal intervention approach restorations are not indicated until the lesion has extended to D2 region, that is, where the probability of cavitation in the enamel is between 10% and 41%.

Direct digital radiography:

- In order to increase reproducibility and accuracy of radiographic caries detection.
- There are two types of digital radiography image system:

a. Charge – coupled device (CCD):

It is composed of a sensor connected directly to the computer through a cable.



b. Storage – phosphor – based:

- The reusable image plate is exposed to radiation to create a latent image.
- The plate is exposed to a laser scanner to obtain the stored information.



Advantages of digital radiography over conventional film-based radiography are:

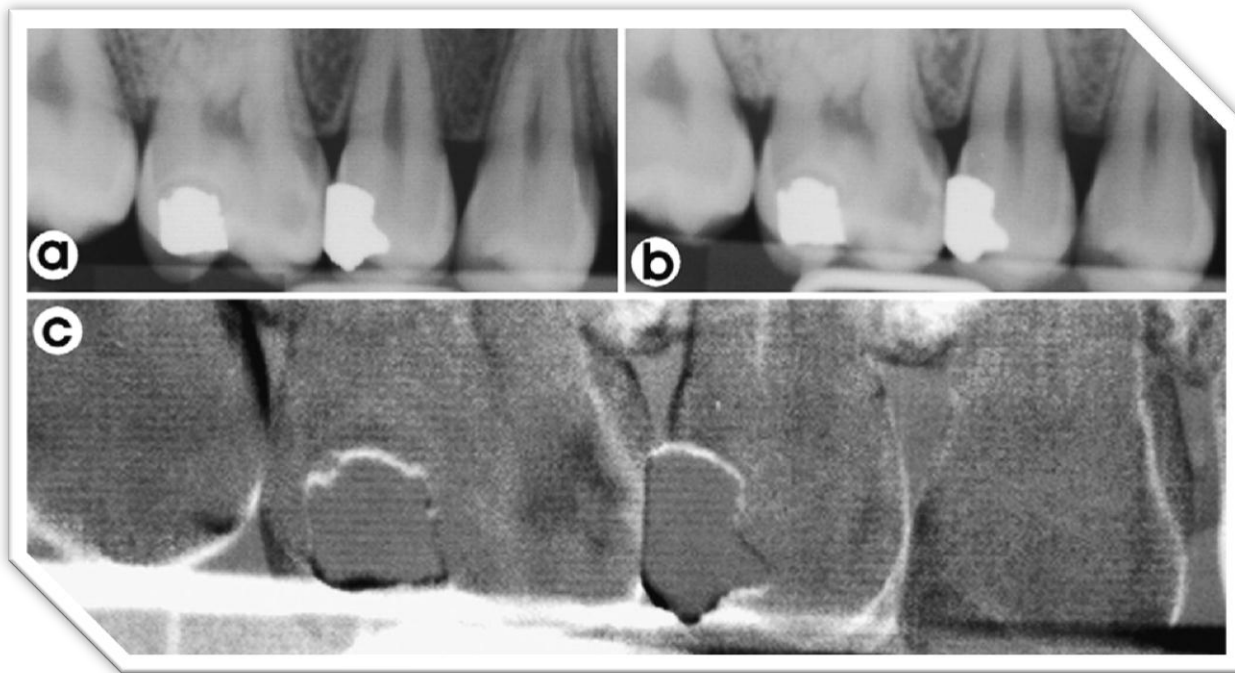
- 1. Ease of manipulation to change contrast and density.**
- 2. No errors associated with chemical processing.**
- 3. Reduced dose down to 50% or less.**
- 4. It takes less time to acquire an image.**
- 5. Image storage and communication is easier with digital networking.**

2)Tuned-aperture computed tomography:

This method construct radiographic slices and cross-sections, through teeth. The slices can be viewed for the presence of radiolucencies

3) Digital subtraction radiography:

It is a computer software that compares the taken radiographs over periods of time to evaluate the progression or regression of the lesion in numeric values.



Laser Technology:

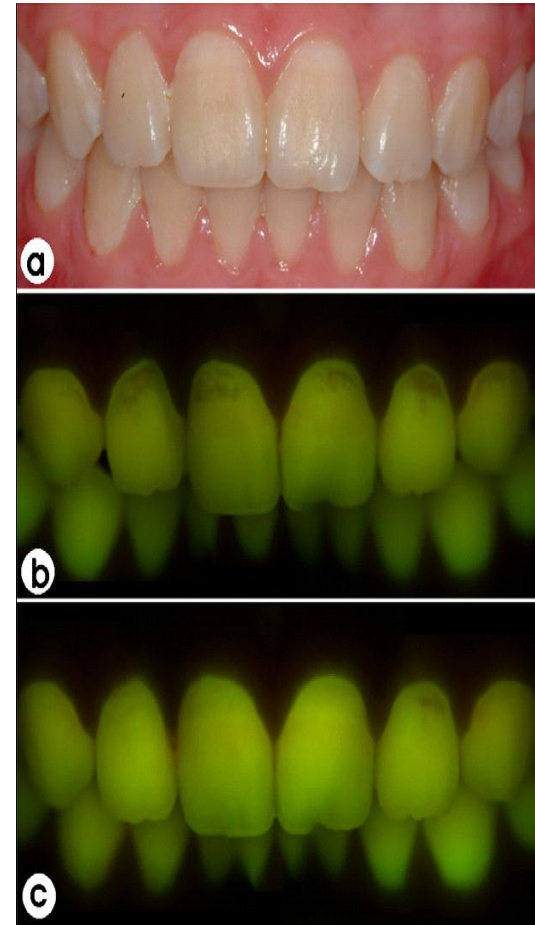
1) **Laser-based device (DIAGNOdent):**

It works on the **fluorescence nature** of bacterial metabolic by-product. The fluorescence is displayed as **numeric value**.



2-Quantitative laser fluorescence (QLF)

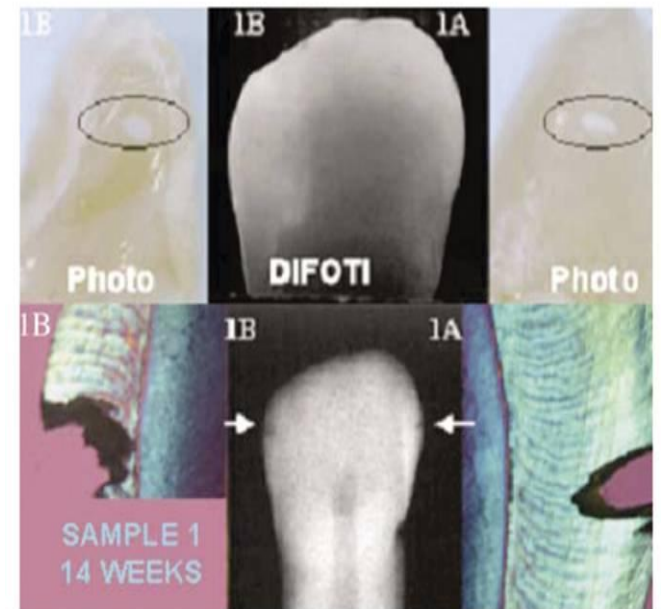
It is a **computer** based method utilizes the **blue green light** from **argon laser**. The difference between the fluorescence of sound and carious tooth structure can be made visible. It allows early detection of caries and monitoring the de- and remineralization process.



Light Technology:

Digital Imaging Fiber Optic Transillumination (DIFOTI):

It Combines 3 technologies; high intensity light, IO camera & computer.



2)ToothSpy:

It is a transillumination device. It sends extremely bright and deep going light through into teeth and gums and immediately detect early caries, existing Implants and Root fillings. it is fast, without x-ray and the results can be shown with an intraoral camera.



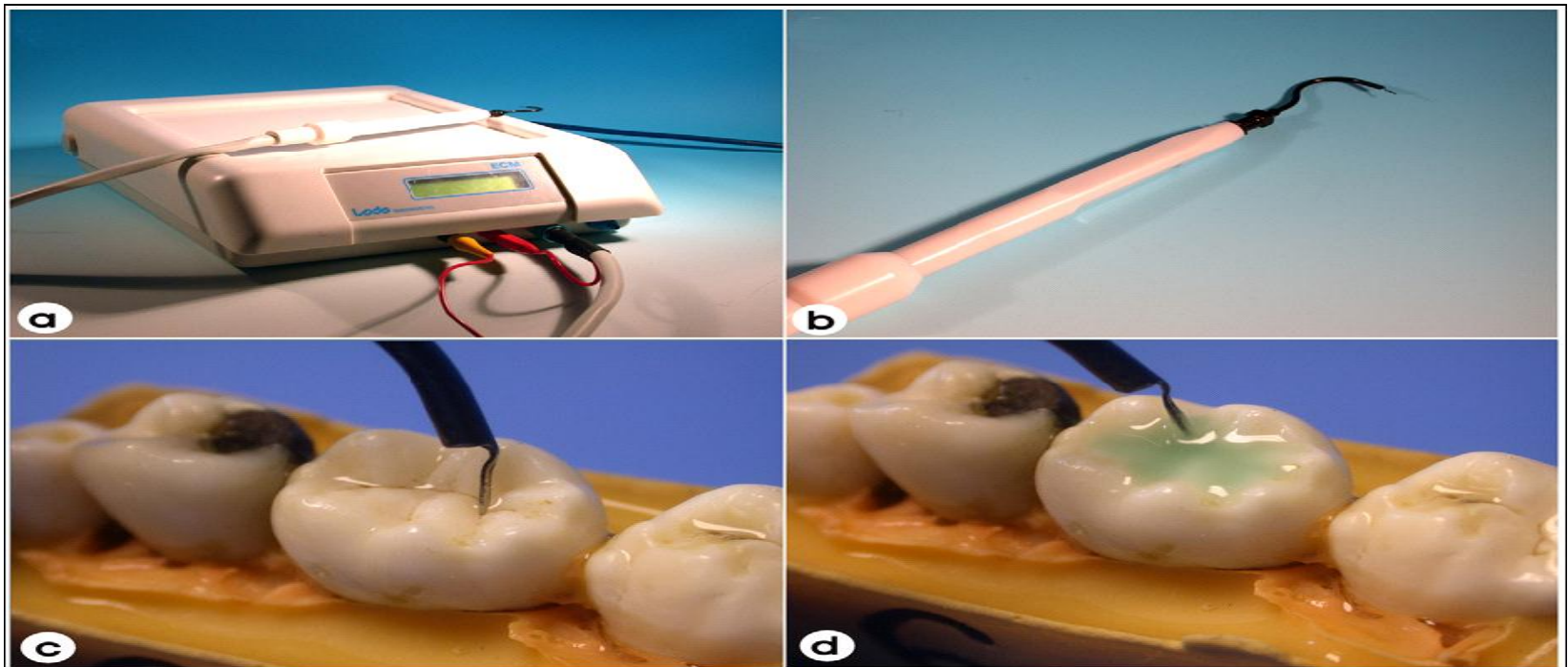
3)Fluorescence aided caries excavation (FACE):

The exciting carious dentin with violet blue light will result in an orange-red fluorescence that could be used to identify residual caries.

Electrical Technology:

1) **Electrical caries monitor (ECM):**

It's based on the **electrical conductivity** differences between sound dental tissues and carious dental tissues in absence of liquid (saliva).



Imaging Technology:

1)Intra-oral camera:

It is a camera placed inside the oral cavity to allow the display of intraoral images on a computer.



2)Extra-oral camera (digital camera):

It Provides the dentist with visual records for the patient which will make it easier to determine proper follow up.



3)Computer imaging:

The dentist can electronically alter a video image of patient's smile. Thus, allowing both the dentist and the patient to visualize, evaluate and select the proper line of treatment.

Ultra-sonic Technology:

Ultrasonic caries detection:

In dentistry, ultrasound has been used to image the tooth and to find carious lesions on smooth surfaces.



Dyes Technology:

Caries detection dyes:

The **dye fills the voids in enamel** and dentin that are created by acid attack, or fills the voids present in hypomineralized enamel.



Application of restorations in teeth with cavitated lesions:

1. Surgical approaches.

**2. Biological or medical model of
treatment.**

1. Surgical approaches:

- According to G.V.BLACK The concept of "Drill and fill" has to be followed, even small lesions being treated with these original principles required enlargement beyond just removal of the diseased tissues for obtaining retention and material strength.
- This concept of "Drill and fill" continued to be the only way to deal with carious and non carious defects for more than 100 years.

2. Biological or medical model of treatment

This model deals with caries as a disease that should be treated prior to any restorative procedure.

It includes the following:

- 1. Diet and habits modification if required.**
- 2. Salivary flow and buffering capacity adjustment if required.**
- 3. Mechanical preventive measures (calculus and oral biofilms control)**

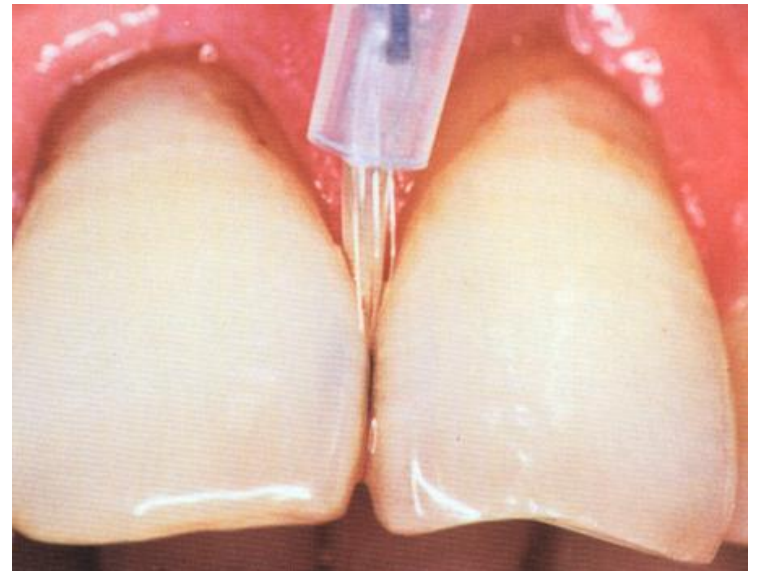
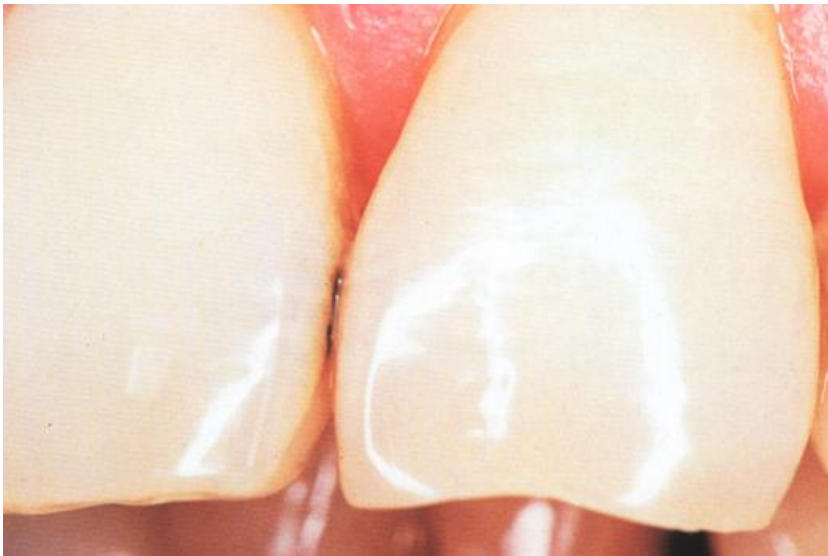
4. Use of antimicrobials :

This is to attack the cariogenic organisms and deal with caries as a disease rather than dealing with its symptoms.

- Chlorhexidine or hexitidine mouthwash could be used twice daily for two consecutive weeks.**
- It could also be in the form of gel applied in custom-made trays or applied as a varnish.**

5. Remineralization of initial lesions:

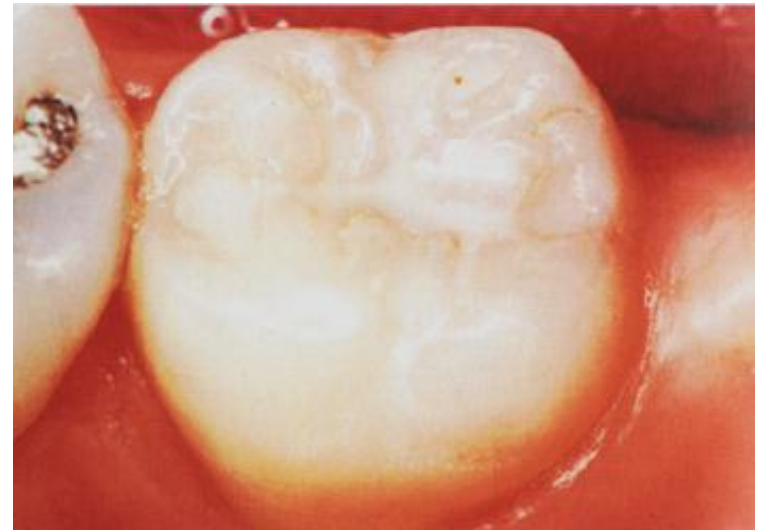
- This is a procedure that could be referred to as healing of demineralized tissues.
- It could be performed using fluorides in the form of solutions or gels, hydroxyapatites, calcium phosphates and triclosan/ copolymer / sodium fluoride.



6. Fissure sealing for susceptible sites:

- **These sealants are in the form of low viscosity resinous materials or glass-ionomers and their modifications.**

● They obliterate pits and fissures that represent good habitats and niches and allow trapping of microorganisms and food substrate.



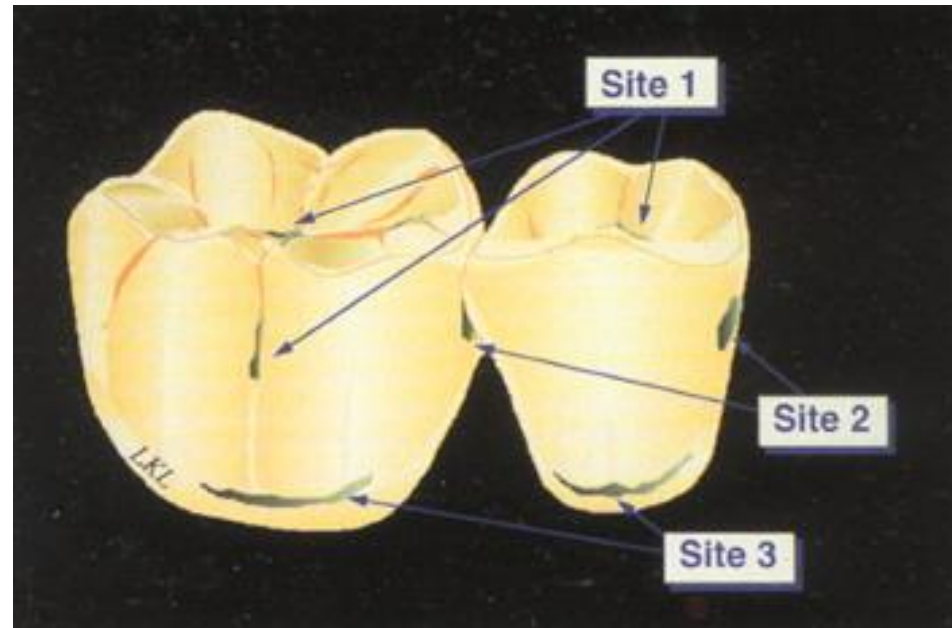
7. Close follow up to monitor the healing procedure.

New Cavity Classification:

- A new classification of cavity based on the new concept has been proposed (*Mount & Hume, 1997*).
- The proposed classification takes into account the fact that there are only three surfaces of the crown of a tooth that can be subjected to caries attacks.

These surfaces are:

Site 1: Pits and fissures on the occlusal surfaces of posterior teeth and other defects on otherwise smooth enamel surfaces.



Site 2: Contact areas between any pair of teeth, anteriors or posteriors.

Site 3: Cervical areas related to gingival tissues including exposed root surfaces.

A neglected lesion will continue to extend, so will the complexities of the restoration increase the sizes that can be readily identified include:

Size 0: Initial lesion at any site can be identified but not yet resulted in surface cavitation. It can possibly be healed.

Size 1: Smallest minimal lesion requiring operative intervention. The cavity is into dentin just beyond healing through remineralization.

Size 2: Moderate-size cavity. There is still sufficient sound tooth structure to maintain the integrity of the remaining crown.

Size 3: There is already a split at the base of the cusp, or if not protected a split will likely develop.

Size 4: The **cavity is extensive**, following the loss of cusp from a posterior teeth or an incisal edge from an anterior.

Minimal or Non-invasive cutting tools

Requirements of ideal cutting tool:

- 1. Comfort, ease of use and ability to discriminate and remove diseased tissues only.**
- 2. Painless, silent, requires minimal pressure for optimal use,**
- 3. Does not generate heat or vibration during operation periods,**
- 4. Affordable and easy to maintain.**

the appearance of several tools have the ability to remove diseased tissue only.

Non invasive cutting tools:

Air-abrasion



Ultrasonic cutting



Laser cutting



(CARISOLV)



Ozone



Air-abrasion technology

Flow of a stream of compressed air (40-140psi) that carries aluminum oxide particles (20-50 μ m)

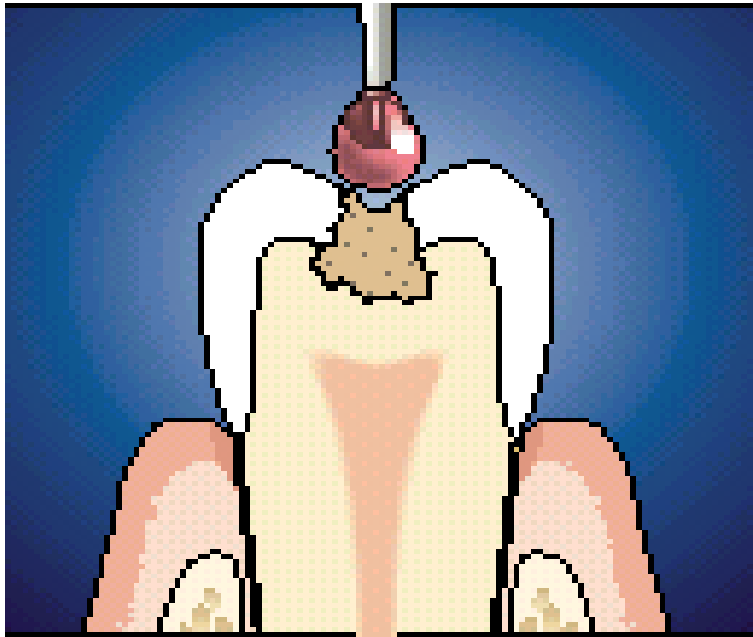


■ It strikes the tooth surface to cut sound enamel, dentin and defective restorations that are to be replaced. However, it's less effective in achieving caries removal.

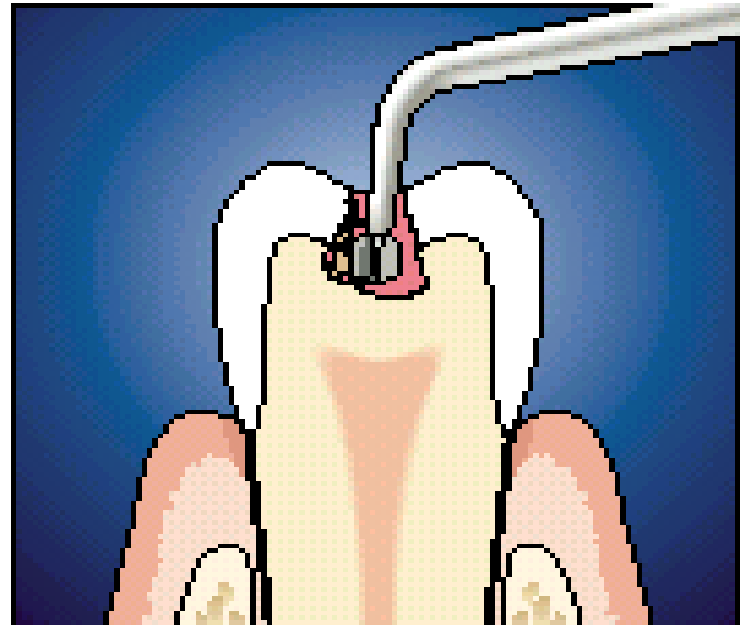
■ It requires a rubber dam, high velocity suction unit and face shields or protective facemasks to control the messy procedure.

Chemo-mechanical caries removal:

A combination of amino acids and a weak solution of sodium hypochlorite in a gel form.



Apply



Scrape

■ It does not affect healthy dentin ,soft tissue or enamel. Consequently, it should be used in combination with other cutting techniques .

■ However, it could be used in root caries, coronal caries with open access and in deep caries approaching the pulp.

Ultrasonic cutting



- Early generations could not preserve tooth structure owing to their large sizes but later on smaller sizes were incorporated .
- However, the preparations could not be totally performed using this technique and hence they cannot be used alone.

Laser cutting

■ The most commonly used types are excimers, which are special ultraviolet lasers. CO2 and Nd: YAG lasers .

■ Lasers are used with caution as they are inefficient at removing large amounts of enamel and dentin and result in generating extensive amounts of heat.



waterlase

Enzymes

■ The enzyme preparation *pronase* successfully disintegrates decayed dentin. It's said to perform digestion of carious dentin.

■ Pronase does not attack sound dentin but solubilizes more than 90% of the nitrogen present in carious dentin. It has no ability to remove sound or carious enamel.

Ozone treatment

- No cutting is performed using this technique.
- It rapidly penetrates the bacteria and kills them in their protected niches.
- It could alter the metabolic products of bacteria that inhibit remineralization and thus allows clinical reversal of the lesion.
- It was found to halt root caries and treat occlusal caries in permanent and deciduous teeth.

■ It's supplied through a medical device known as HealOzone that produces ozone in the unit by passing air through high voltage.



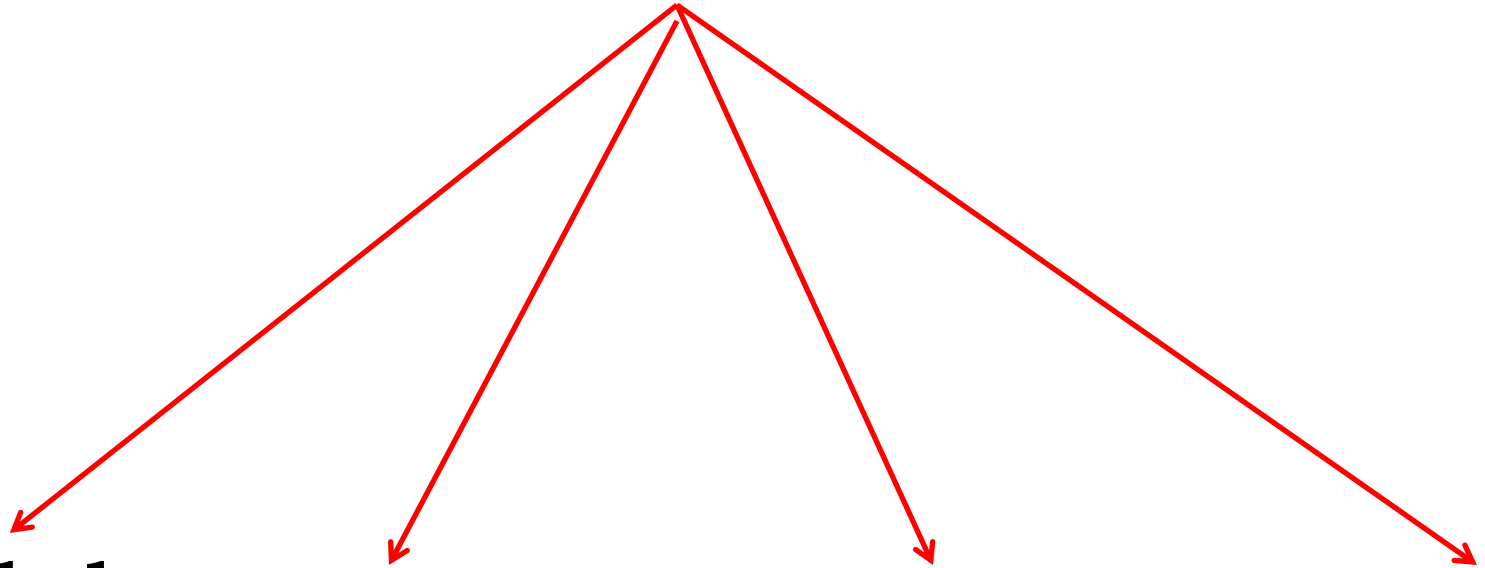
Healozone

■ Ozone reaches the lesion via a handpiece covered by a cup that is placed on the lesion for a period of 10 seconds. This results in deactivation of 99% of bacteria, fungi and viruses.



■ This is followed by suction to eliminate any ozone remnants. A time lapse of 3 months should be allowed for remineralization of treated tissues which are rather soft before any restorative procedure.

Recent conservative cavity designs:



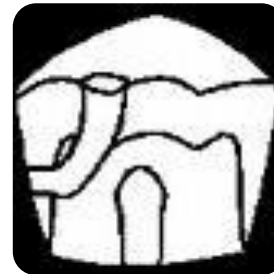
Simple box preparation



Slot preparation

Tunnel preparation

ART



Conservative cavity designs.

◆ Overzealous removal of healthy tooth tissue is considered un-allowed to provide neither flat floors nor squaring out the cavity as in Black's design.

◆ The finished preparation then very much resembles the shape of the carious lesion it replaces but with refinements to satisfy certain requirements.

◆ In approximal caries: The cavity is said to have no corners.


◆ Thorough condensation of amalgam is difficult with this design but the placement of bonded restoration is **BETTER**


1. Preventive resin restorations (PRR)

It's a technique that allows for the removal of fissure caries, including any associated dentinal caries and its restoration with a resin composite material.

No attempt to make special retentive areas or extension into sound pits or fissures

 When caries is limited to enamel, there's no need to prepare into dentin

 Small cavities could be restored with a flowable composite that may also act as a fissure sealant

 However, it's advocated to use filled wear-resistant composites followed by fissure sealants to seal the adjacent fissures.

2. Simple box preparation

Indication

- + A small proximal lesion without either occlusal fissures .**
- + Narrow interproximal contact.**
- + The outline could have rounded margins as in resinous material or could be in the form of definite walls as in case of amalgam restoration.**
- + It's mainly used whenever there's a need to avoid cutting into sound occlusal surfaces.**

Outline

■ Buccal and lingual walls of the box should be almost facing each other to maximize retention.


Restoration:


Using amalgam or resin composite according to the cavity design.



Slot preparation

Indication

 In old patients who have gingival recession and often experience cavities on the proximal exposed cementum on the root surfaces

 whenever wide embrasures are encountered that allow easy access to the proximal lesion

Outline

✂️ The approach to perform this design is buccally or lingually in the form of a slot.

Advantages:

- 😊 Better esthetic.
- 😊 Does not alter occlusal relationships.
- 😊 Preserve a natural proximal contact



Restoration

Amalgam, resin composite or glass-ionomer and its modifications.

Tunnel preparation

■ This type of preparation is also termed internal fossa, internal oblique preparation, internal occlusal diagonal preparation or simply internal preparation.



■ A diagonal inclination of the cutting tool is done to keep the marginal ridge without undermining it.

■ Air-abrasion has proven effectiveness lately in performing such a design.

■ **Partial tunnel:** When The decayed tissue is removed without involvement of the approximal enamel.

■ **Total tunnel ” :** when the approximal enamel has been perforated by the carious lesion and removed during the preparation.