PREVENTION OF DENTAL CARIES

Dental caries continues to be number one problem in dentistry.

It should receive the major attention not only from the standpoint of restorative procedures, but more important from the standpoint of preventive Procedures to reduce the problem.

Etiology of dental caries

1- acidogenic theory.

2- proteolytic theory.

3- protolysis-chelation theory.

ACIDOGENIC THEORY

It is a two stage process there is decalcification of the enamel which also results in the destruction of the dentin.

In the second stage there is dissolution of the softened residue of the enamel and dentin.

In the first stage ***the destruction is done by the acid*** attack where as ***the dissolution of the residue is carried by the proteolytic action of the bacteria's.***

This whole process is supported by the presence of carbohydrates microorganisms and dental plaque .

PROTEOLYTIC THEORY

Microorganisms invade the enamel lamelle and the acid produced by the bacteria's causes damage to the organic pathways in advance

Microorganisms produce proteolytic enzymes, which destroy the organic matrix of enamel, loosening the apatite crystals….so they are eventually lost and tissue collapses.

PROTEOLYSIS CHELATION THEORY

The bacteria's attack on the surface of the enamel this is initiated by ***keratinolytic microorganisms*** this result in the breakdown of the protein chiefly keratin and results in the ***formation of soluble chelates*** which decalcify enamel even at neutral PH

Mucopolysaccarides may also act as secondary chelators.

CHELATION

It is a process in which there is complexing of the metal ions to form complex substance through coordinate covalent bond which results in:

poorly dissociated /or

weakly ionized compound

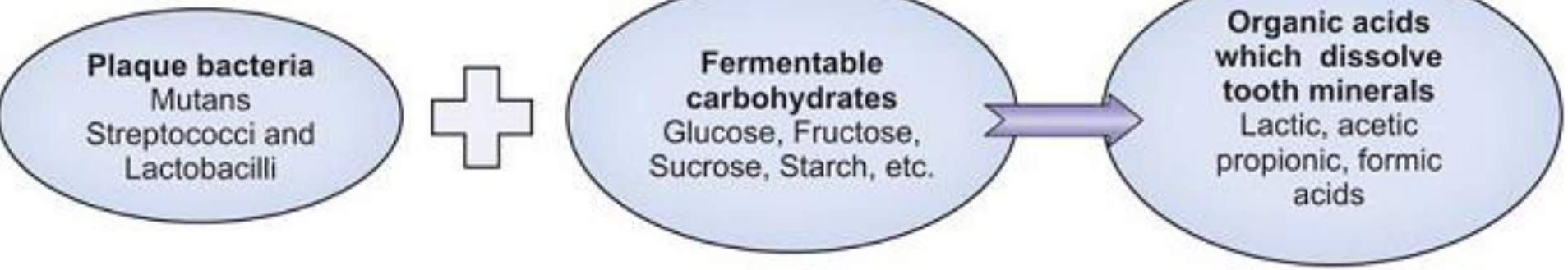
According to acidogenic theory, the oral bacteria in the dental plaque attached to teeth surfaces act on the carbohydrates, particularly freely fermentable type (sucrose) producing acid. This acid attacks the calcified tooth material dissolving it producing dental caries.

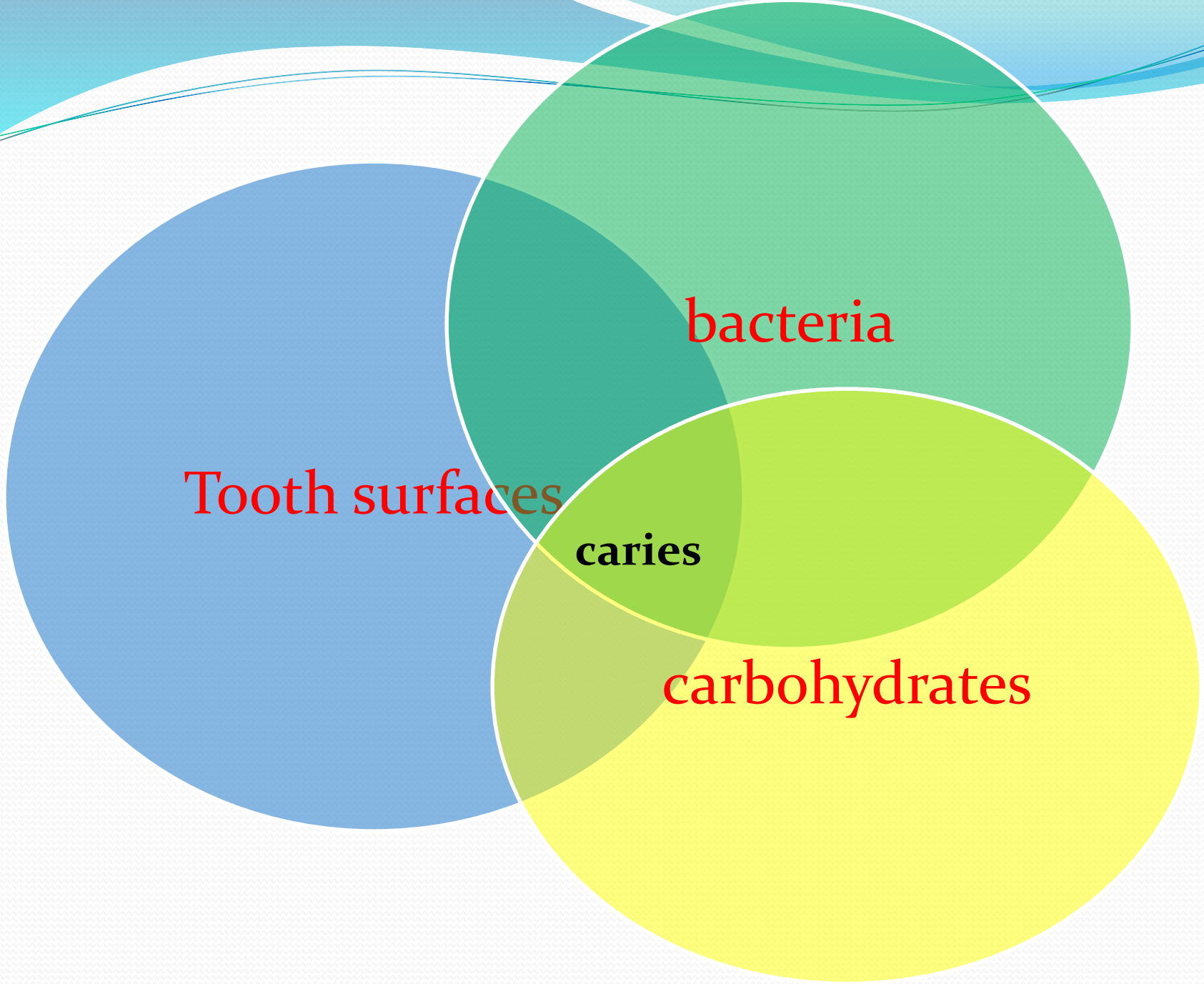
Bacteria + sucrose --------» Acid

Acid + susceptible tooth surface

--------»dental caries

The elimination of anyone of these factors would diminish or prevent dental caries.


Plaque bacteria
Mutans
Streptococci and
Lactobacilli
Fermentable
carbohydrates
Glucose, Fructose,
Sucrose, Starch, etc.
Organic acids
which dissolve
tooth minerals
Lactic, acetic
propionic, formic
acids


bacteria
Tooth surfaces
caries
carbohydrates

PREVENTION OF DENTAL CARIES

I- Dietary Control of Dental Caries (dietary measures)

1- Reduction of carbohydrates consumption.

2- Sucrose substitutes.

3- Addition of caries inhibiting agents.

II. Oral Hygiene Measures:

1-Tooth brushing.

2. Other Cleaning Devices.

3. Oral Rinsing.

4. Dental Prophylaxis.

III- Topical protection of teeth:

1- Fissure sealants.

2- Preventive resin restoration.

3- Atraumatic restorative treatment.

4- fluoride.

I- Dietary Control of Dental Caries (dietary measures)

Diet can affect the teeth in two ways:

A- Pre-eruptive effect:

During tooth formation before eruption, after birth essential nutrients carried by the blood stream from the digestive tract,

or **before birth** through the placental circulation from the mother to the fetus, provide the calcium and vitamin D for proper development and maturation of the teeth which would be less likely to decay.

B- Post-eruptive effect:

Through the oral environment, by controlling the lodgment around the teeth of freely fermentable Carbohydrates debris which clears slowly from the mouth.

1- Reduction of carbohydrates consumption:

Carbohydrates should not be completely restricted but *dietary recommendations* can be given to the patient to improve the oral environments, these are:

1. Keep the carbohydrate content of the diet as low as possible. No more than half the daily calories be carbohydrate.

Balanced diet

Carbohydrates---------- 50%.
Proteins ---------- 15%.
Fat ---------- 35%.

1/gm of carbohydrates---------- 4k cal
1/gm of proteins ---------- 4k cal
1/gm of fats ---------- 9k cal

Children requirements of carbohydrates

o – 6 month-----» 120 k cal
12 -13 year------» 60 k cal

Diet for good general nutrition

It must be contain

- Minerals especially calcium and phosphorous.
- Vitamins particularly vitamins D&C.
- Low carbohydrates, especially freely fermentable varieties.

A good balanced diet can be best attained by including the four basic food groups in proportion:

1. The milk group
2. The meat group
3. The vegetable &fruit group.
4. The bread & cereals group.

2. Select the soluble forms or those that clear from the mouth quickly. Leafy vegetables are good carbohydrate sources with low retention. Avoid sticky candy and suckers (e.g. biscuit).

Oral clearance of carbohydrate

How quickly food is cleared from the mouth dependent on how much saliva, pH, how fast it clears. Some forms of carbohydrates take longer time to be cleared from the mouth. The caries activity is greater with increase in clearance time; this is because it stays for longer time in contact with the surfaces of teeth. sticky sweets such as chocolate, toffee, caramel, are much more harmful than similar amount of more directly soluble carbohydrates as sucrose

3. Consume carbohydrate at meals avoid between meal snacks.

substitute the sticky sweets with nuts, fruits or vegetable for the in-between meal snacks if such snacks are unavoidable.

4. Cheese is recommended as a caries-preventive food:

Increase → salivary flow
calcium concentration
pH to 7 within 3 min.

2- Sucrose substitutes:

Sucrose is a traditional sweetener, it is sweeter than any simple carbohydrate, except invert sugar (mixture of glucose and fructose obtained by hydrolyzing sucrose) and it is cheaper than any other carbohydrate.

The replacement of ***sucrose, glucose, and fructose*** with artificial sweeting agents, such as aspartame, mannitol, and saccharin reduce the cariogenicity of a food or renders it non-cariogenic.

Sorbitol sweetened chewing gum and candy are much less cariogenic than sucrose-sweetened products.

Xylitol is used in confectionery and tooth paste. Since it inhibits certain streptococci and less cariogenic than sucrose and Sorbitol.

The use of sucrose-substitutes is an effective means of caries controlling depends on the palatability of the products.

3- Addition of caries inhibiting agents and food:

1-Fluoride

The addition of fluoride to foods (salt, milk, bread, and flour) presents a problem as the individual consumption of any items varies considerably.

2- Inorganic and organic phosphate:

•organic phosphate act primarily by forming a tightly bound protective layer on the enamel surface. Whereas inorganic phosphates act mainly by a common ion effect.

3- Dextranease:

Reduces the adherence of bacteria to the tooth surface

4- Cheese as mentioned before.

Diet history analysis

.It is done when vague reports from patients make it impossible to determine whether an adequate diet is being obtained.

The patient recorded his exact food intake for a period of ***one day, 3 days or preferably one week***, and then analyze the report for calories, carbohydrates, protein, fat, minerals and vitamins.

Results are then compared with the ideal dietary recommendation.

Importance:

1-provide diagnostic and therapeutic value in counseling individual patient.

2- Help in giving good dietary recommendations for changing the dietary habits of patient which may help in improvement his caries condition.

3-Help discussion with the patient to define his dental and diet problem and to discover solutions.

4- General guides to improve nutritional level.

5- Make the parents actively involved in recoding the diet history of their child.

Technique:

1. The parents of the child have to record child exact food intake.
2-Analyze the report for calories, carbohydrates. Protein, fat, important minerals and vitamins.
3-Compare, the resuits with the recommended dietary allowances and with the desirable distribution of food among the four basic food groups.

4-Dtermined the total amount of carbohydrates, consumed and the time at which it is consumed.

5. According to this analysis recommendations for changing the dietary habits can help in improving patient' caries condition.

How to predict the future dental caries?

Caries activityTests

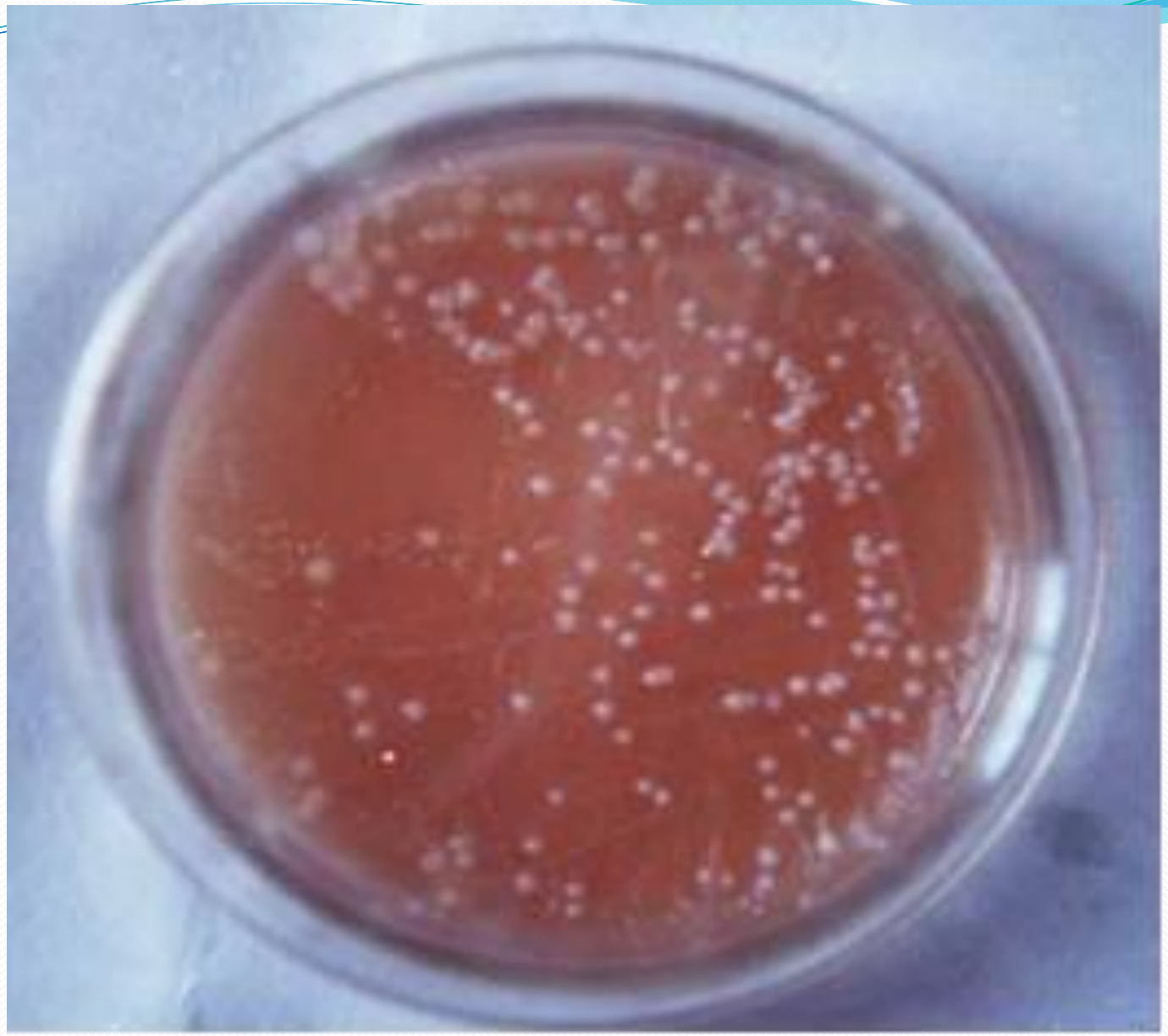
Theses tests aim to predict future Caries activity and used to provide an illustration of acid production in carious process.

A- The lactobacillus count test

This test is based on the assumption that caries is a process whereby fermentable carbohydrate debris in the mouth is broken down into acid by oral microorganisms such as lactobacilli and streptococci. There is generally a correlation between the number of lactobacilli and dental caries activity, so the lactobacillus count test has as its objective to find the number of lactobacilli present in a patient's mouth in order to predict his susceptibility.

-In this test a specimen of saliva is collected by the patient chewing on a cube of paraffin wax first thing after getting up in the morning and spitting into a sterile bottle.

-The saliva is diluted (1 ml is mixed with 4 ml beef extract) spread on tomato agar plates (pH5) and incubated for 96 hours.



The colonies are counted and the number of lactobacilli per ml are calculated:

----Patients with a count over 10,000--- marked caries activity.

----Patients between 5000 and 10,000 moderate activity.

- patient between 1000- 5000 slight activity.

----Patients below 1000 very slight or none.

B-Methyl red test

The use of water soluble methyl red pH indicator for disclosing those areas of the tooth surface that develop hydrogen Ion concentrations below pH 5.2

Aqueous methyl red (0.216%) is a chemical indicator that changes from yellow at pH 6 or above to deep red at pH 5.

Enamel dissolves at pH 5.2 .

1-This solution (yellow color) is applied to all the teeth and after half a minute some areas of red coloration appear indicating acid formation.

2-The patient then rinses with 1% sugar solution.

3- After few minutes reapply methyl red solution.

The change in color to red in new active carious areas may suggest the site of future caries.

C. The Snyder test

This test measures the ability of oral microorganisms to form acid from a Carbohydrate medium.

A sample of 0.2 ml of the saliva inoculated into a glucose agar medium with indicator ***bromocresol green***.

This is incubated along with a control media without saliva.

The change in color to yellow indicates a fall in pH or acid formation:

-If the change occurs within 24 hours, it indicates marked caries activity in the child.

-If it occurs within 48 hours, it indicates moderate activity.

-If it occurs within 72 hours, this indicates slight caries activity.

-If the change occurs above 72 hours, this indicates no caries activity.

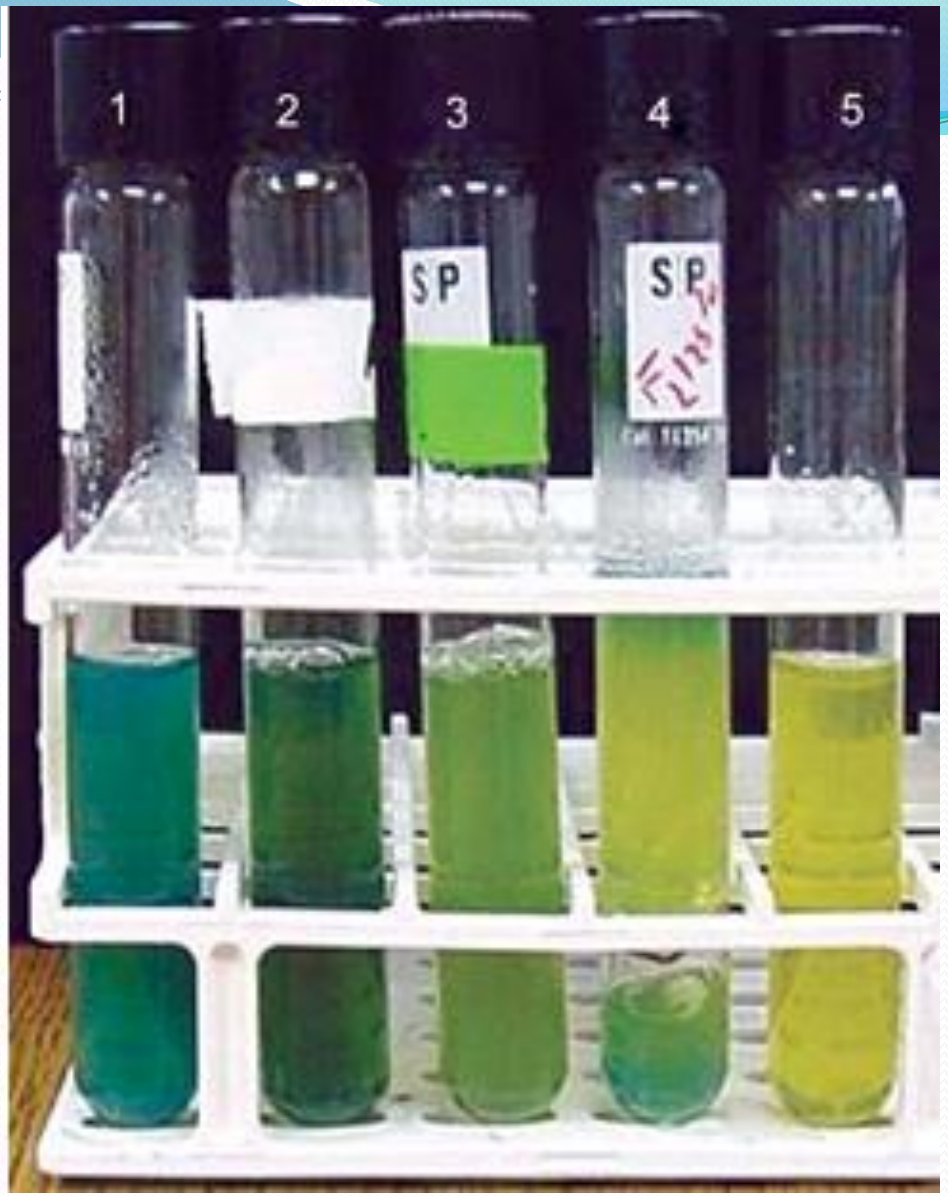
d-The Modified Snyder test (Alban's test)

It uses the same formula as Snyder's media with the exception that less agar is added.

1- A 5ml tube of semisolid agar is removed from the refrigerator but is not heated.

2-The patient is asked to spit unstimulated saliva directly into the tube until there is a thin layer of saliva covering the surface of the green agar.

3- The tube is then incubated for 4 days. Color changes will be observed.


1
2
3
4
5
SP
SP

- Zero score no color change.
- 1+ score color change to yellow in the top ¼ of the tube.

- 2+ score color change to yellow in the half way mark.

- 3+ score color change to yellow in the 3/4 mark.
- 4+ score color change to yellow in the entire length of the agar column has changed to yellow.

Alban's test is probably most predictive at 4 + score at the end of 24 hours (very susceptible) or zero at the end of 96 hours (very resistant).

E- dip slide method:

1- Dip-slide method for lactobacillus count:

A specially designed dip slide of plastic is coated with lactobacilli selective agar added to undiluted, paraffin-stimulated saliva is flowed over the agar surface. The slide is then placed into sterile tube, which is tightly closed and incubated at $37C^0$ for 4 days. It is then removed, and the colony density is determined by comparing it with a model chart.

Reading ↑ 10.000 colonies/ml of saliva ⟹ high.

Reading 1000 -10.000 colonies\ml ⟹ medium.

Reading ↓ 1000 colonies \ml ⟹ low.

2- Dip-slide method for S. mutans count:

This method is very similar to that of lactobacilli.
-Undiluted, paraffin stimulated saliva is poured on a special plastic slide that is coated with Mitis Salivarius Agar, containing 20% sucrose.

-Two discs containing 5 ug of Bacitracin are placed on the agar 20 mm apart.
-The slide is then tightly screwed into covered tube and incubated at 37°C for 48 hours in a sealed candle jar.

The density of Streptococcus Mutans colonies is evaluated as follows:

= Low when the colonies are discrete less than 200 colony.

= Medium when the colonies are more than 200 colony.

= High when the colonies are tiny and uncountable.

The dip slide method is simple, practical and cost reasonable to be used in a private dental office.