

Comprehensive Biofilm analysis and their implications in Dentistry



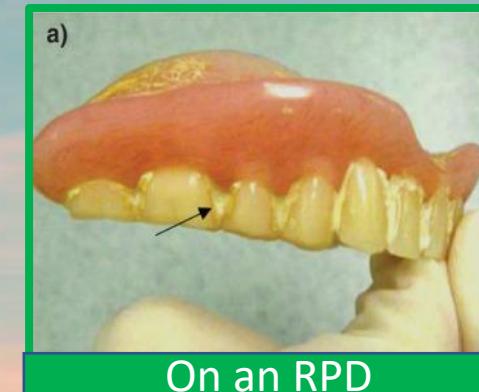
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(Reader)
Dr. Nikita Gulati
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According to **Carranza and Newman**, Dental plaque is defined clinically as a structured, resilient, yellow-grayish substance that adheres tenaciously to the intraoral hard surfaces, including removable and fixed restorations



INTRODUCTION

Oral health is linked to the equilibrium between the host and its commensal microbiota. Qualitative and quantitative shifts of the oral microbiome can lead to dysbiosis, an imbalance that is responsible for the development of microbe-related pathologies. The oral biofilms are easily harvested from oral surfaces and its analysis is important for understanding of its role in the development and pathogenesis of infectious oral diseases.

HUMAN MICROBIOME

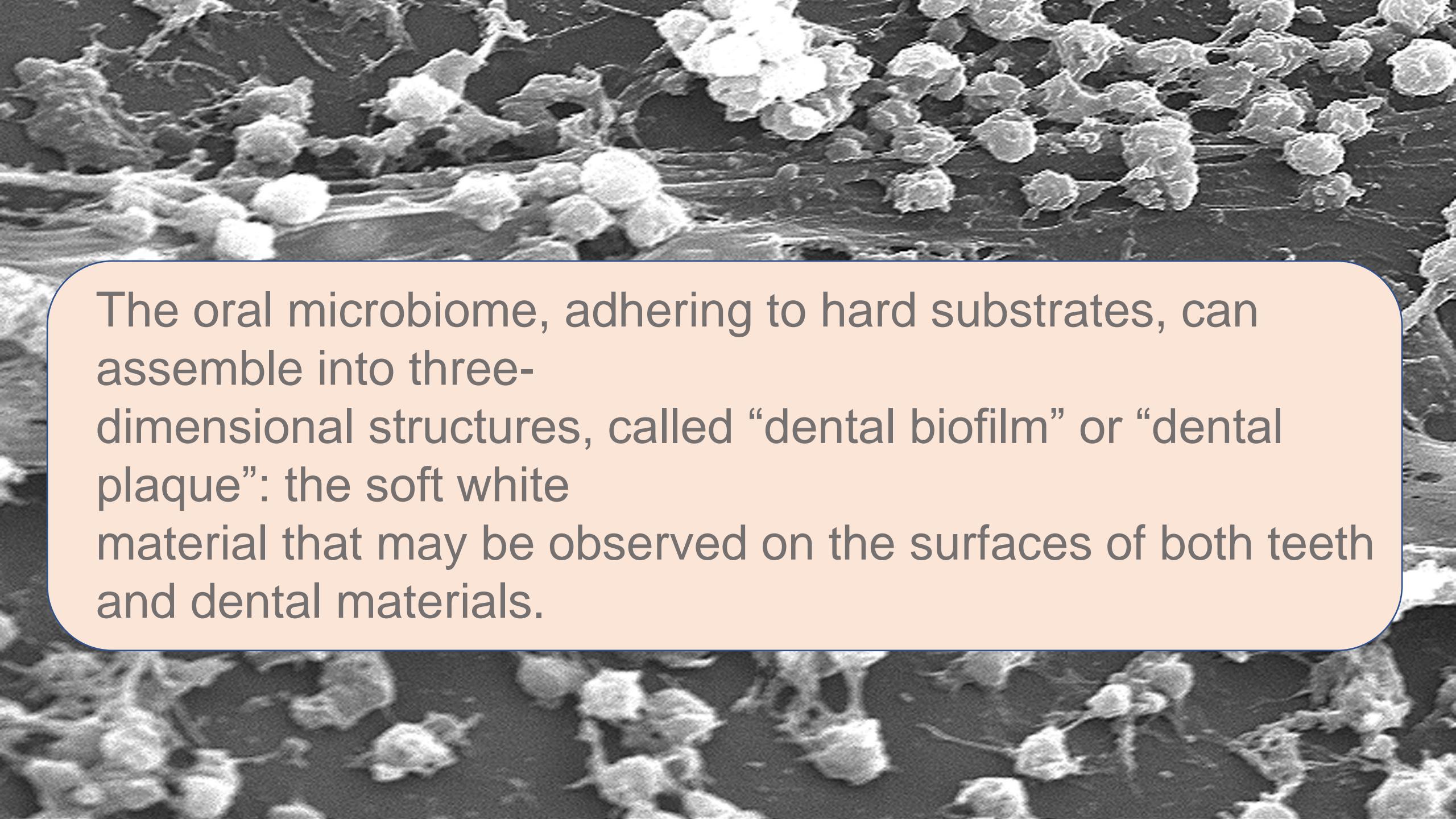
Aggregate of the microorganisms i.e. bacteria and fungi that reside on the surface and deep layers of skin , in the saliva and oral mucosa in the conjunctiva and gastrointestinal tracts

Colonization of habitat by pioneer microbial populations

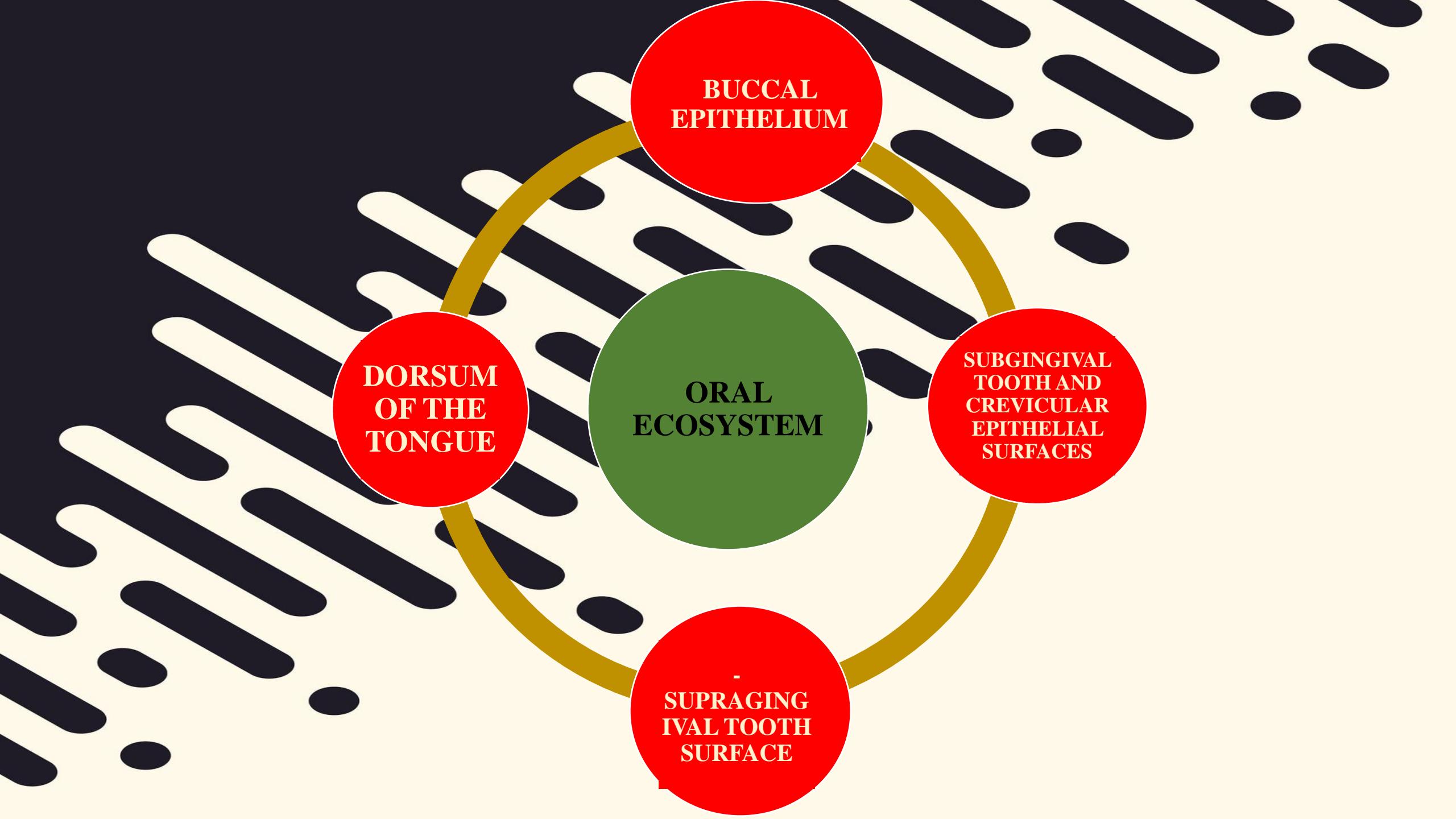
In newborns, streptococci are the pioneer organisms.

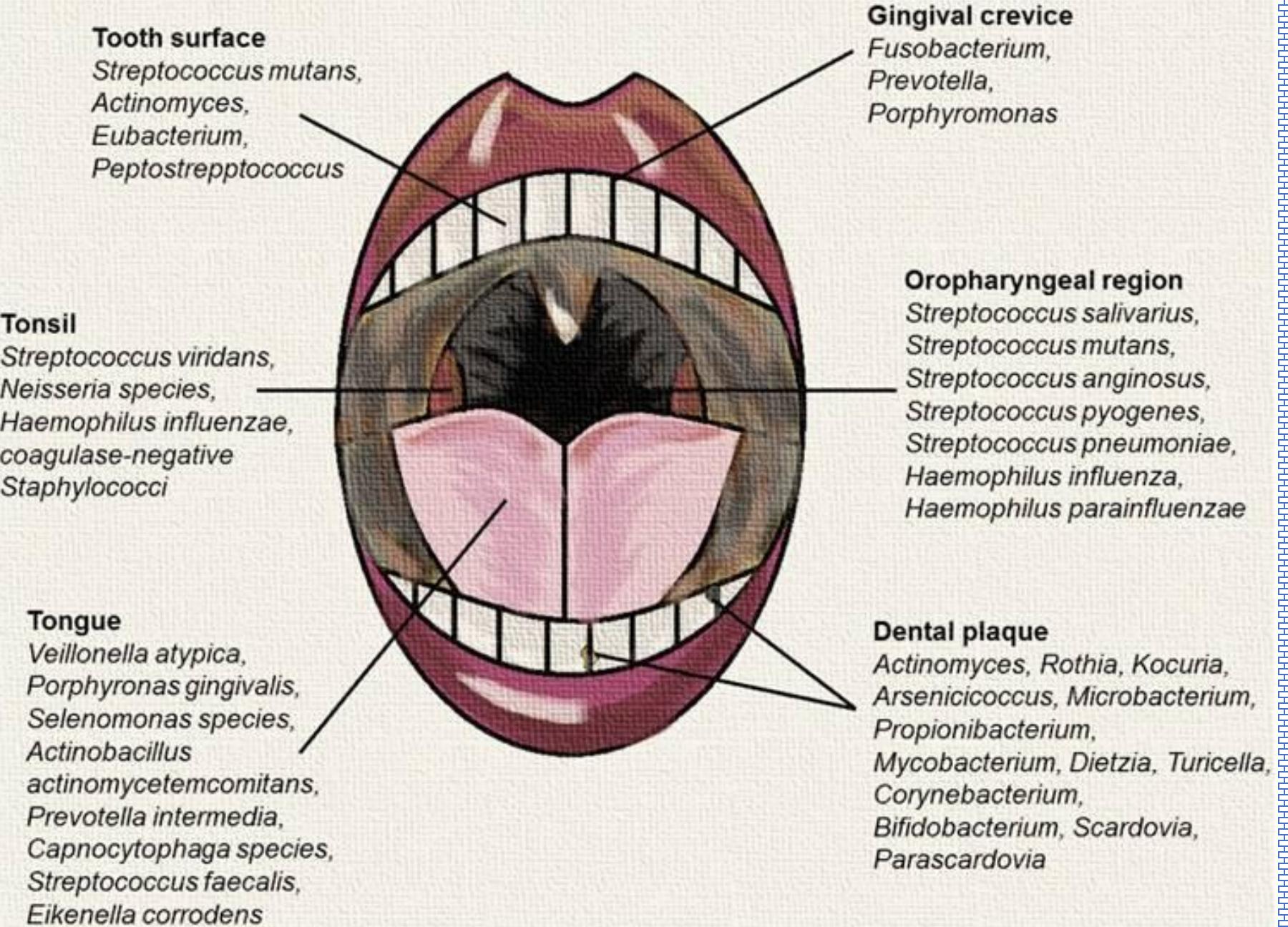
They fill the niche of the new environment, modify it and form the new population .

A stable climax community develops when no additional niche is available for the new population



The oral microbiome, adhering to hard substrates, can assemble into three-dimensional structures, called “dental biofilm” or “dental plaque”: the soft white material that may be observed on the surfaces of both teeth and dental materials.







MATERIA ALBA



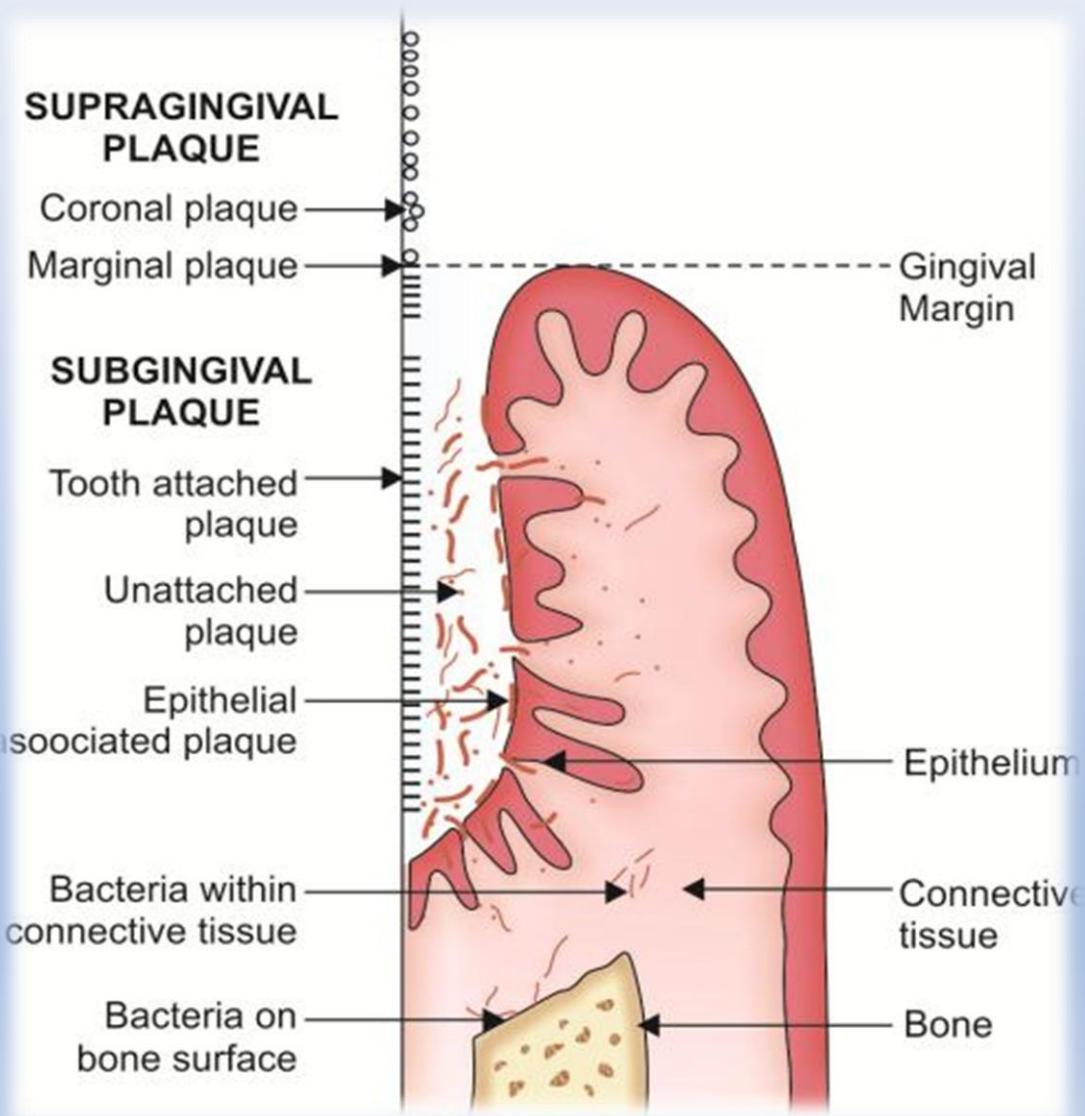
CALCULUS

Some Basics...

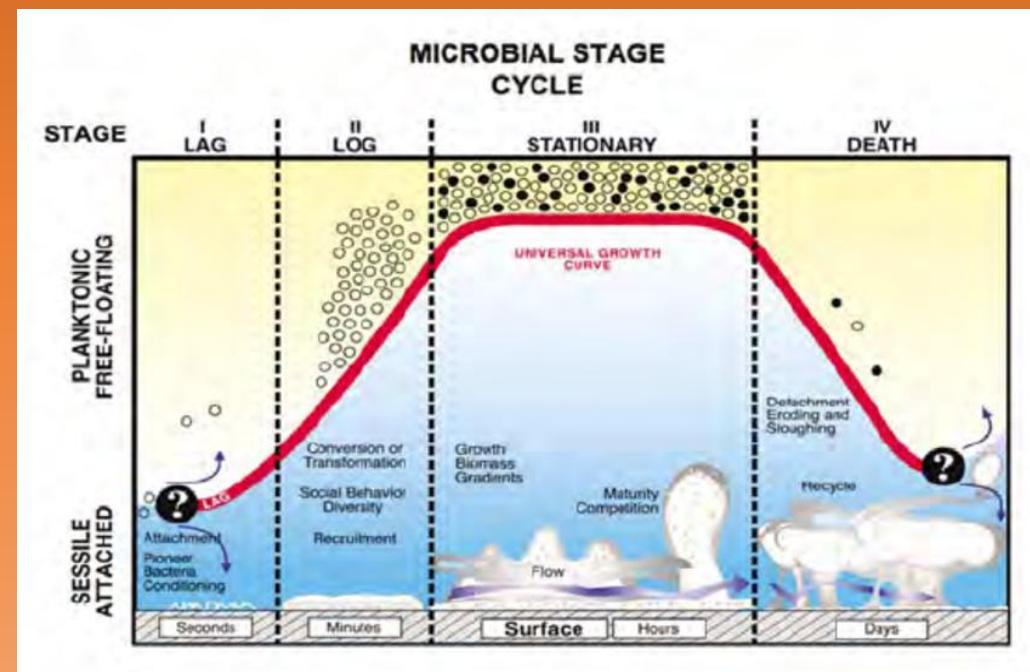
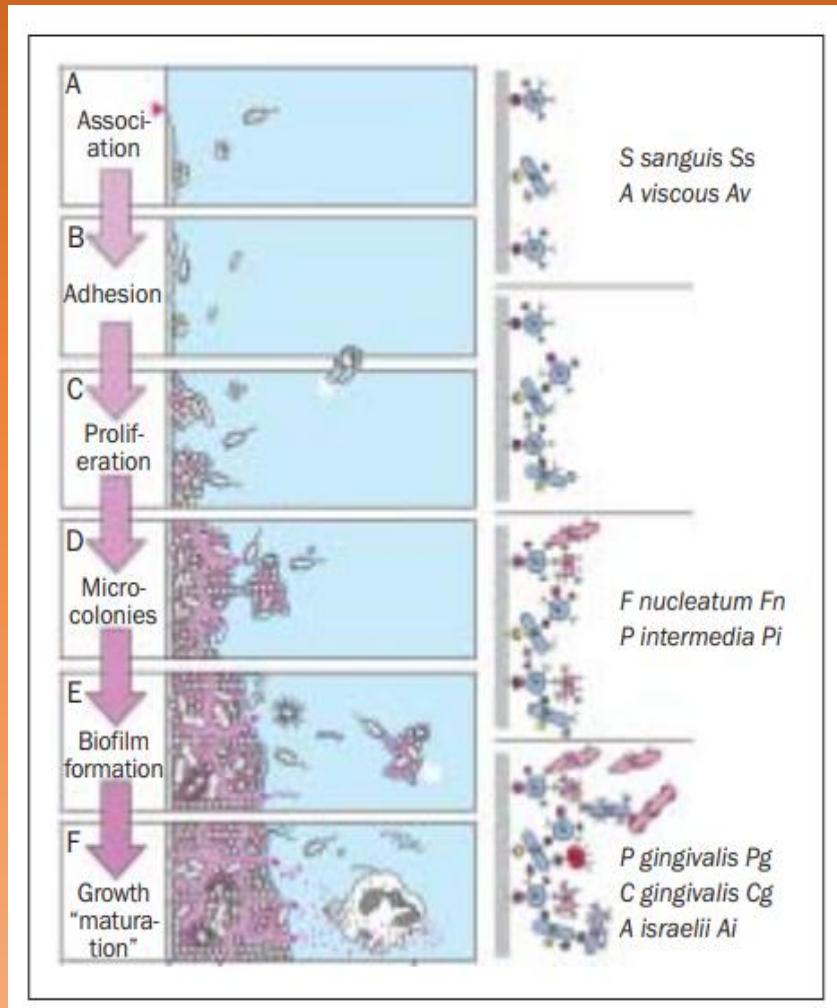


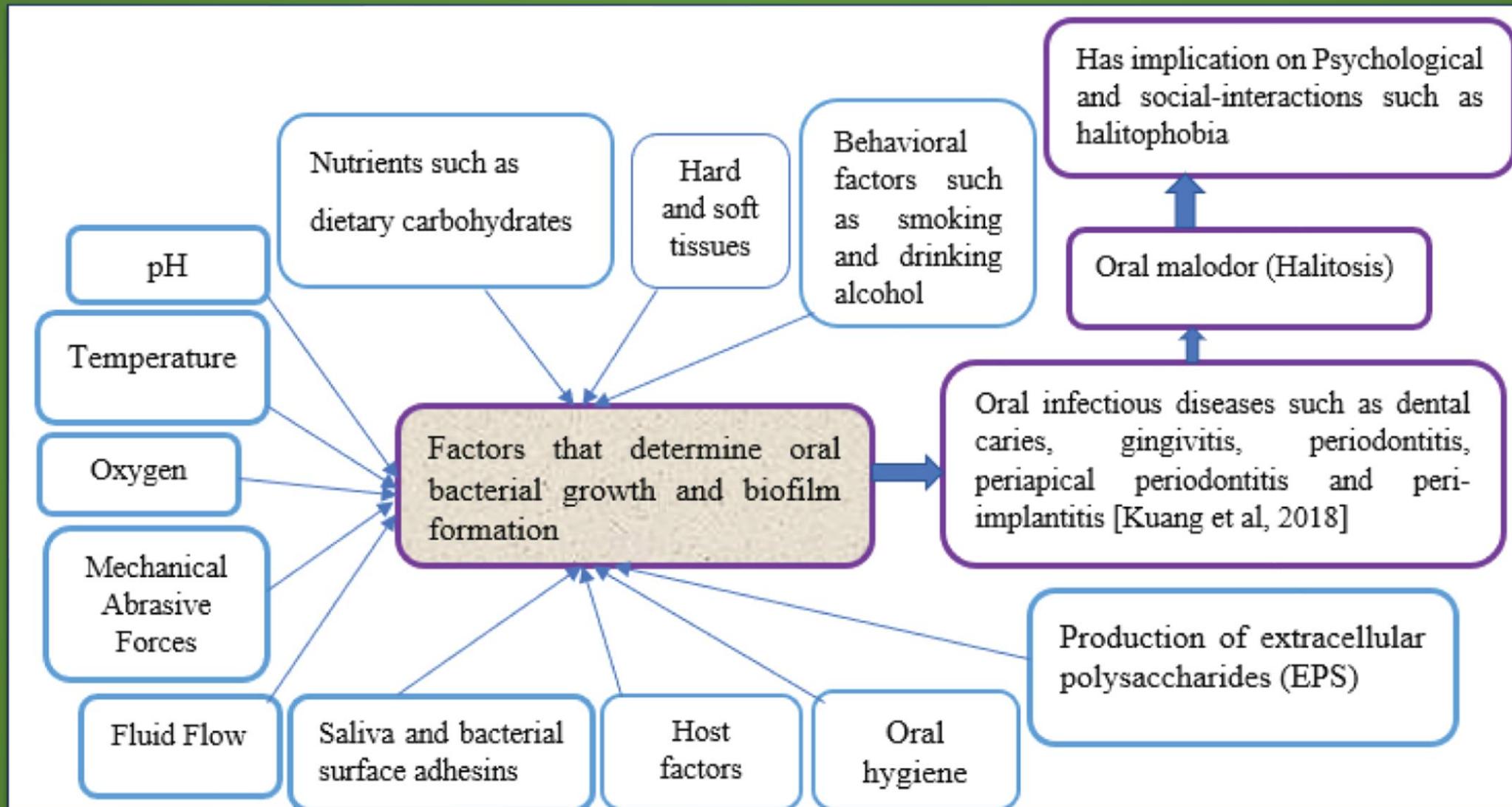
PLAQUE

CLASSIFICATION



FORMATION





Comprehensive
Biofilm analysis and
their implications in
Dentistry

Our
Study



Aim:

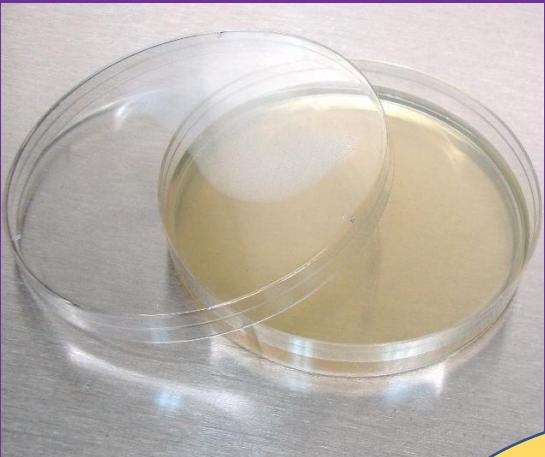
To analyze biofilm composition and its implications in dentistry

Objectives:

- > To compare the colony counts of aerobic and anaerobic bacteria on a natural tooth surface, prosthesis and on orthodontic brackets
- > To compare the bacteria in the dental plaque on a natural tooth surface, prosthesis, orthodontic bracket and on a periodontally diseased tooth.
- > Before collecting the plaque samples, patient's plaque levels and salivary pH levels were assessed



ANAEROBIC JAR



BHI PLATES



GRAM STAIN



COLONY COUNTER



PBS SOLUTION



COMPOUND MICROSCOPE



GAS PACK



COTTON SWAB & EPINDORPH

ARMAMENTARIUM

METHODOLOGY

1. Patient Selection



Group 1:
Patients with no periodontal
problem

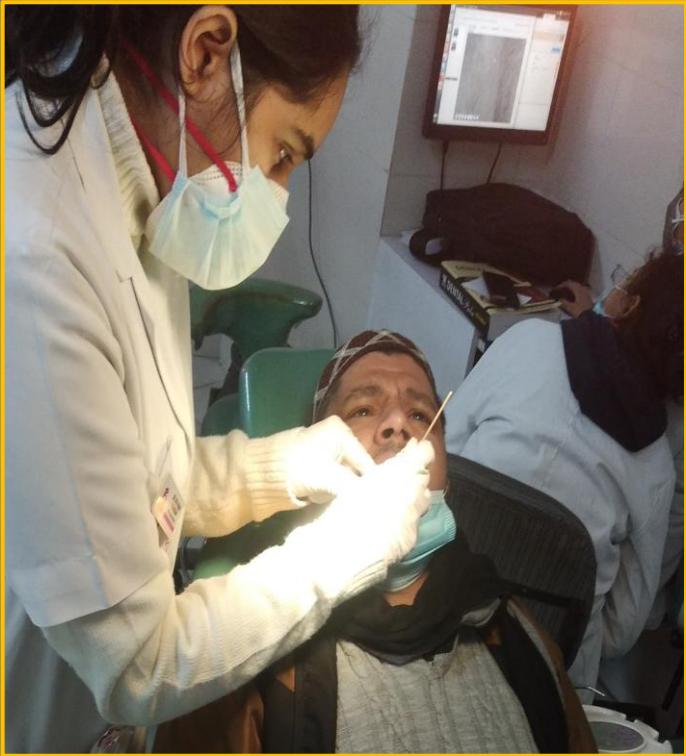


Group 2:
Patients with periodontal
disease



Group 3:
Patients with prosthesis

2. Sample Collection

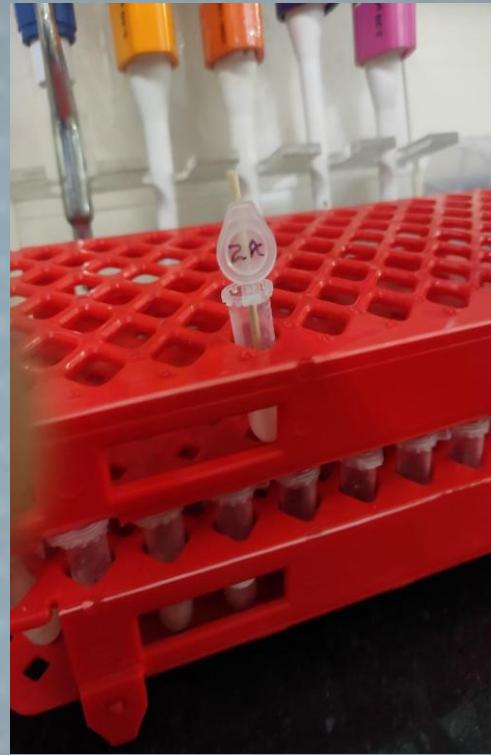


Sample Collection using cotton swab

3. Transport and Storage



Sample diluted to one fold
in PBS immediately



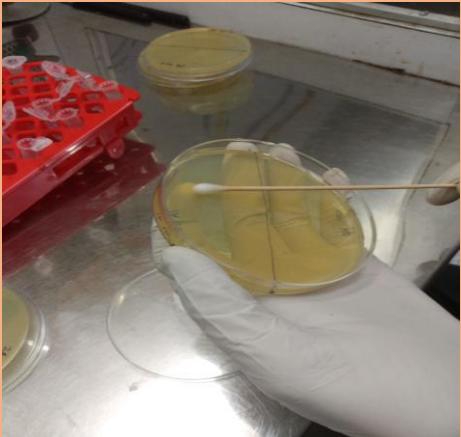
Each Eppendorf tube was
labelled according to the
group



These were stored in
the fridge at -20°C

4. Microbiological Analysis

Aerobic Culture



Placed in incubator for 24 hours at
37°C

Anaerobic Culture

Using
-Gas Pack
-Anaerobic gas jar



Placed in incubator for 72 hours
at 37°C

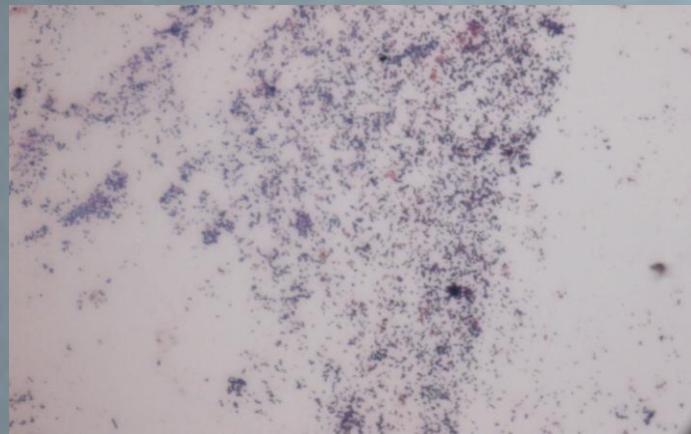
5. Colony Count



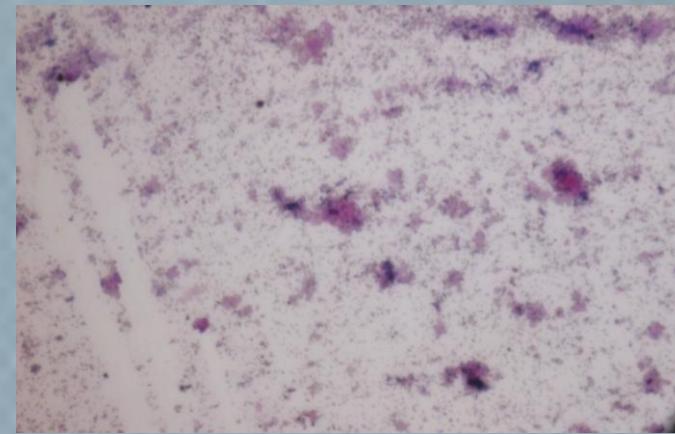
6. Gram staining the samples

Aerobic

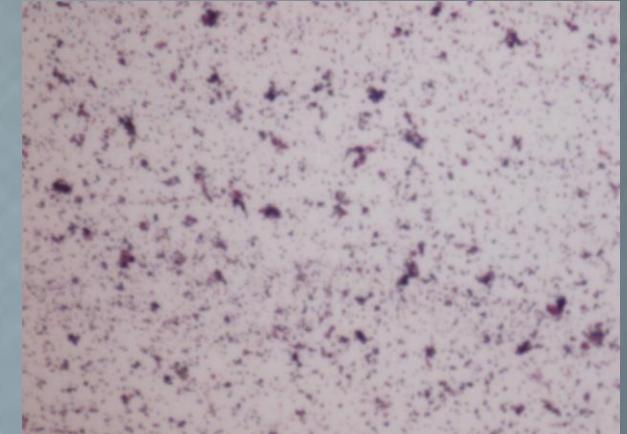
40x



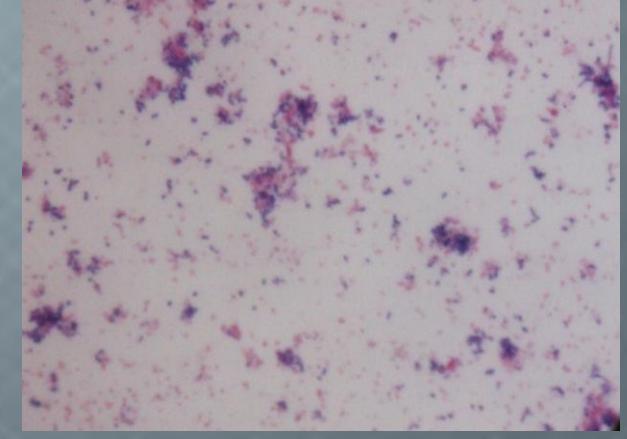
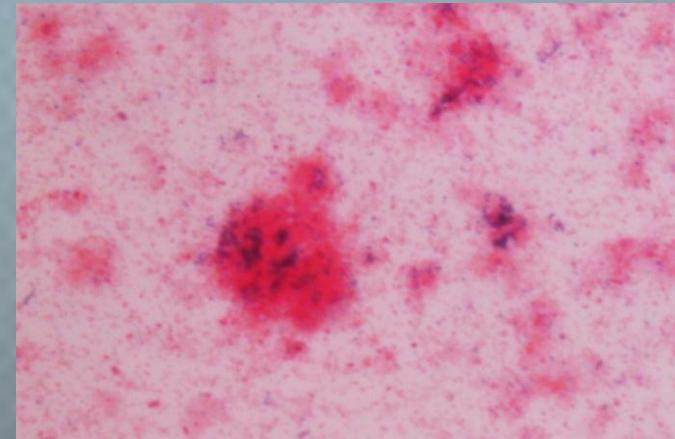
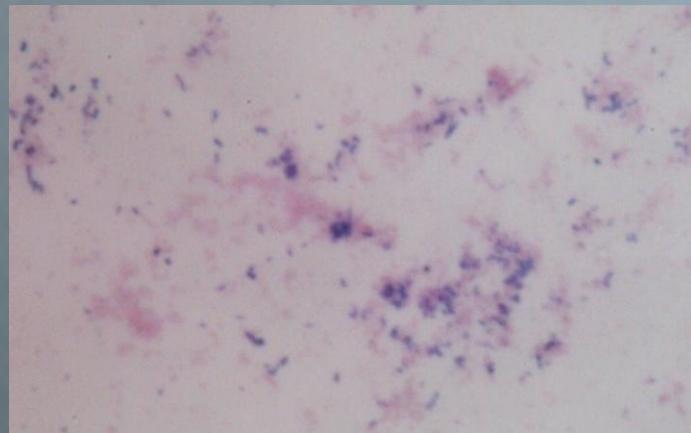
Group 2



Group 3



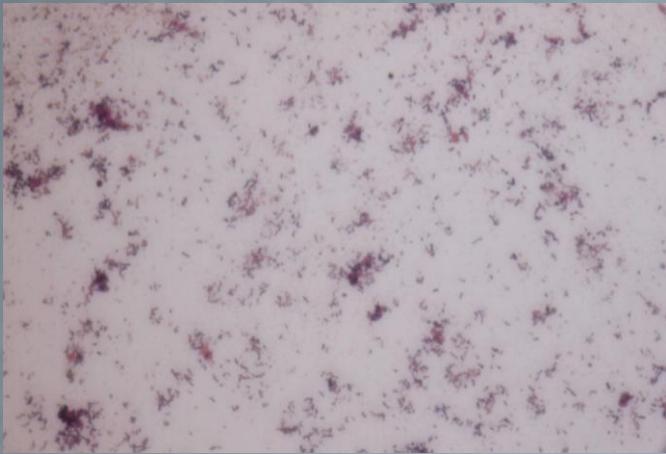
100x



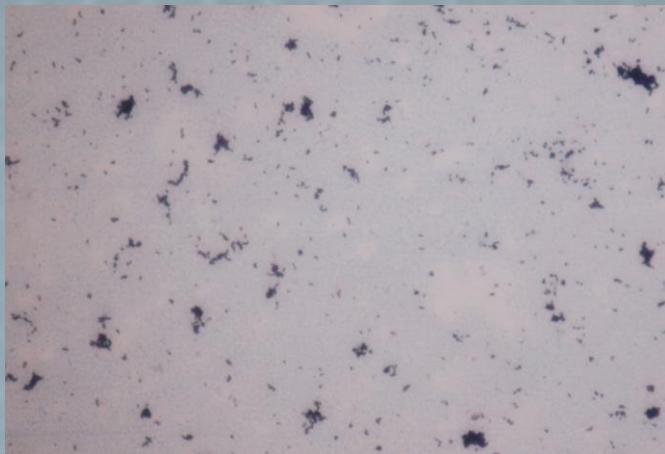
Anaerobic

Group 1

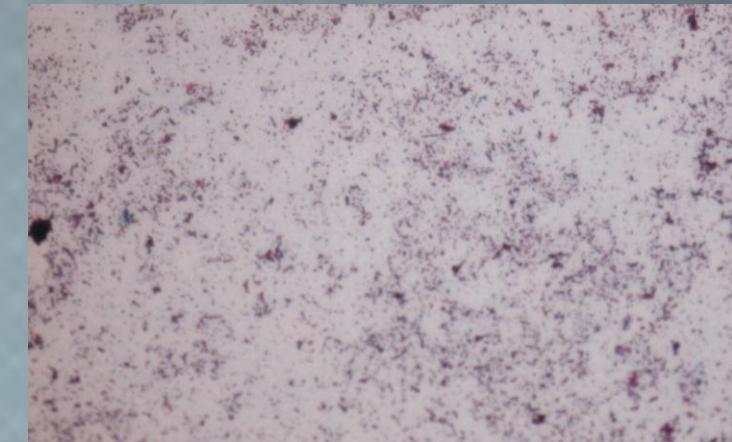
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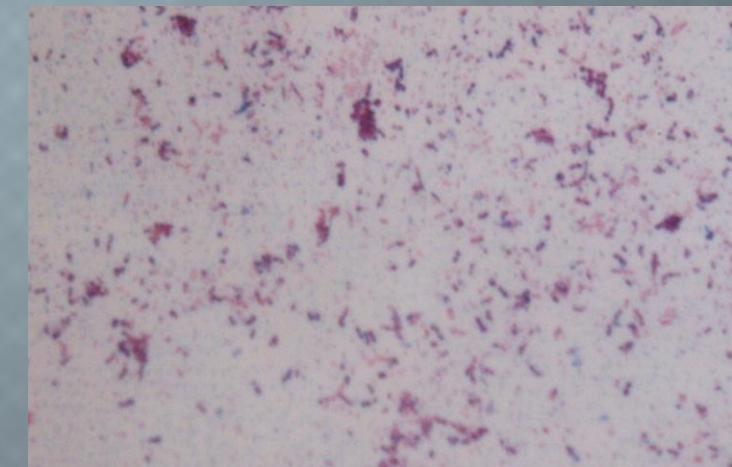
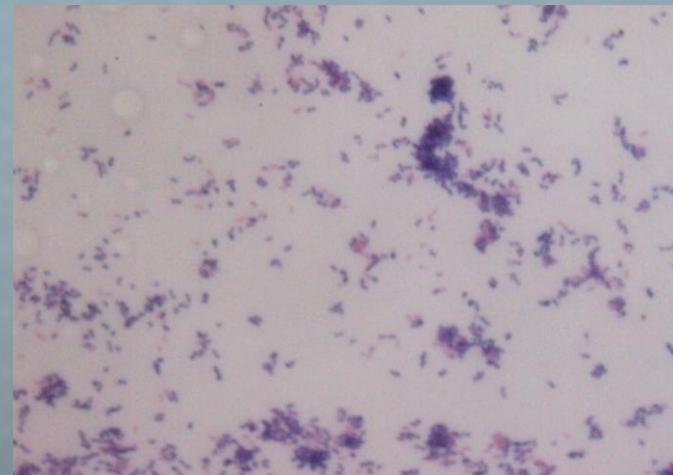
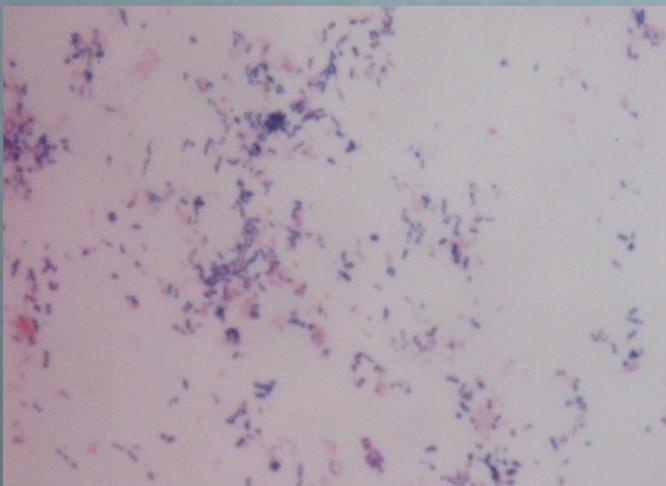
Group 2



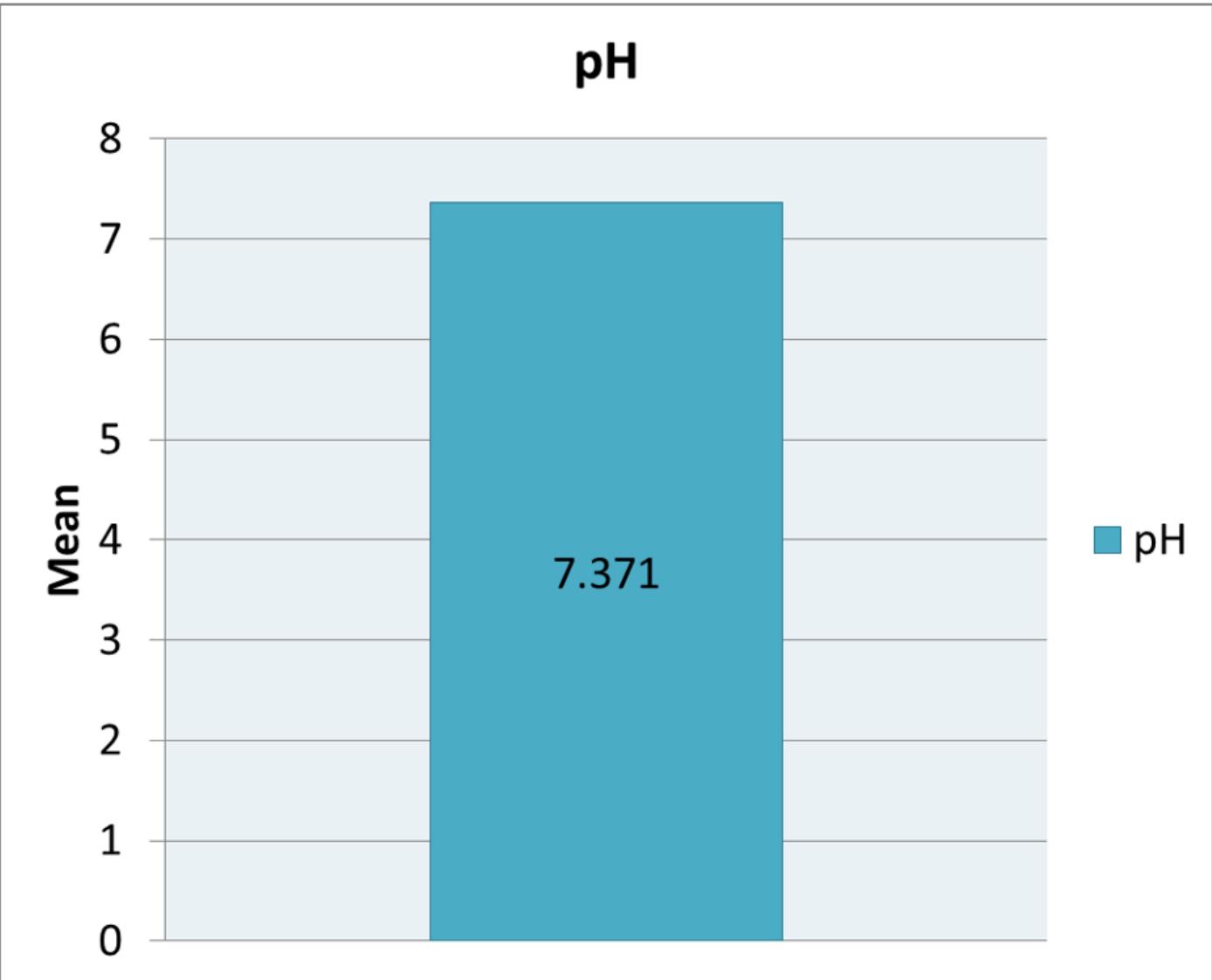
Group 3



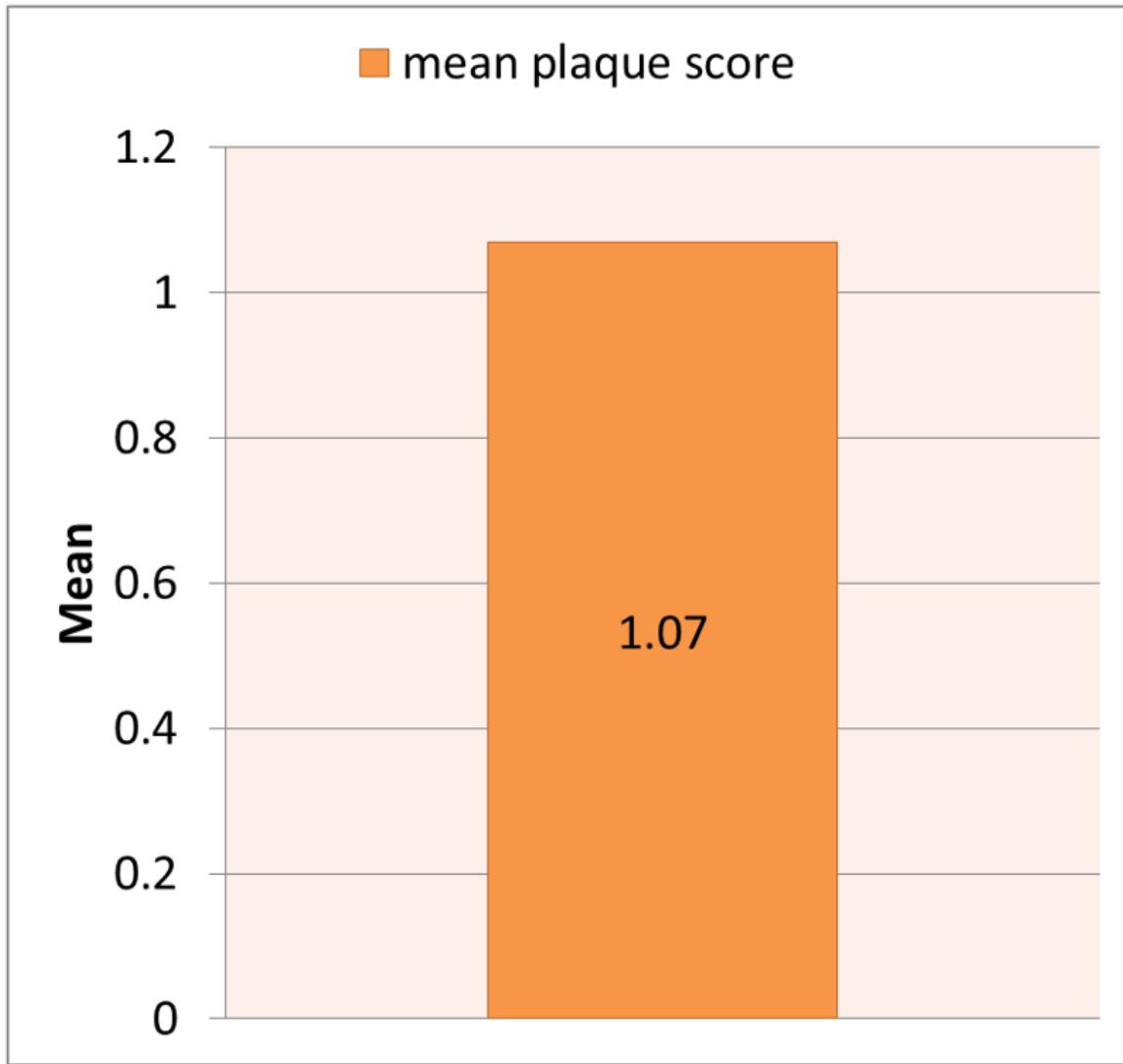
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RESULTS



Mean salivary pH of the study population

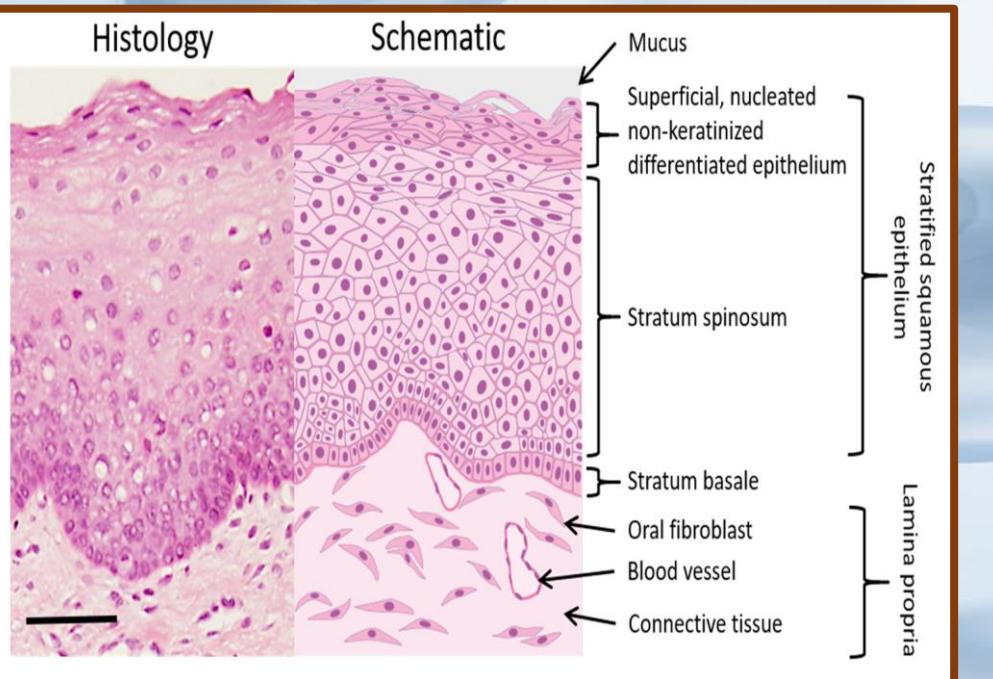


Mean plaque score among the study population

Groups	Mean	SD	Std. Error Mean	P value
Control				
Periodontal compromised patient	260.75	123.56	25.22	
FPD	162.50	41.20	8.41	
Implants	175.70	67.28	3.11	
Orthodontic brackets				

	Orthodontic brackets	Mean	SD	Std. Error Mean	P value
Aerobic count	Type 1	196.33	75.63	15.43	0.035*
	Type 2	158.33	40.75	8.31	
Anaerobic count	Type 1	64.41	76.52	15.62	0.0001*
	Type 2	4.16	1.09	.22	

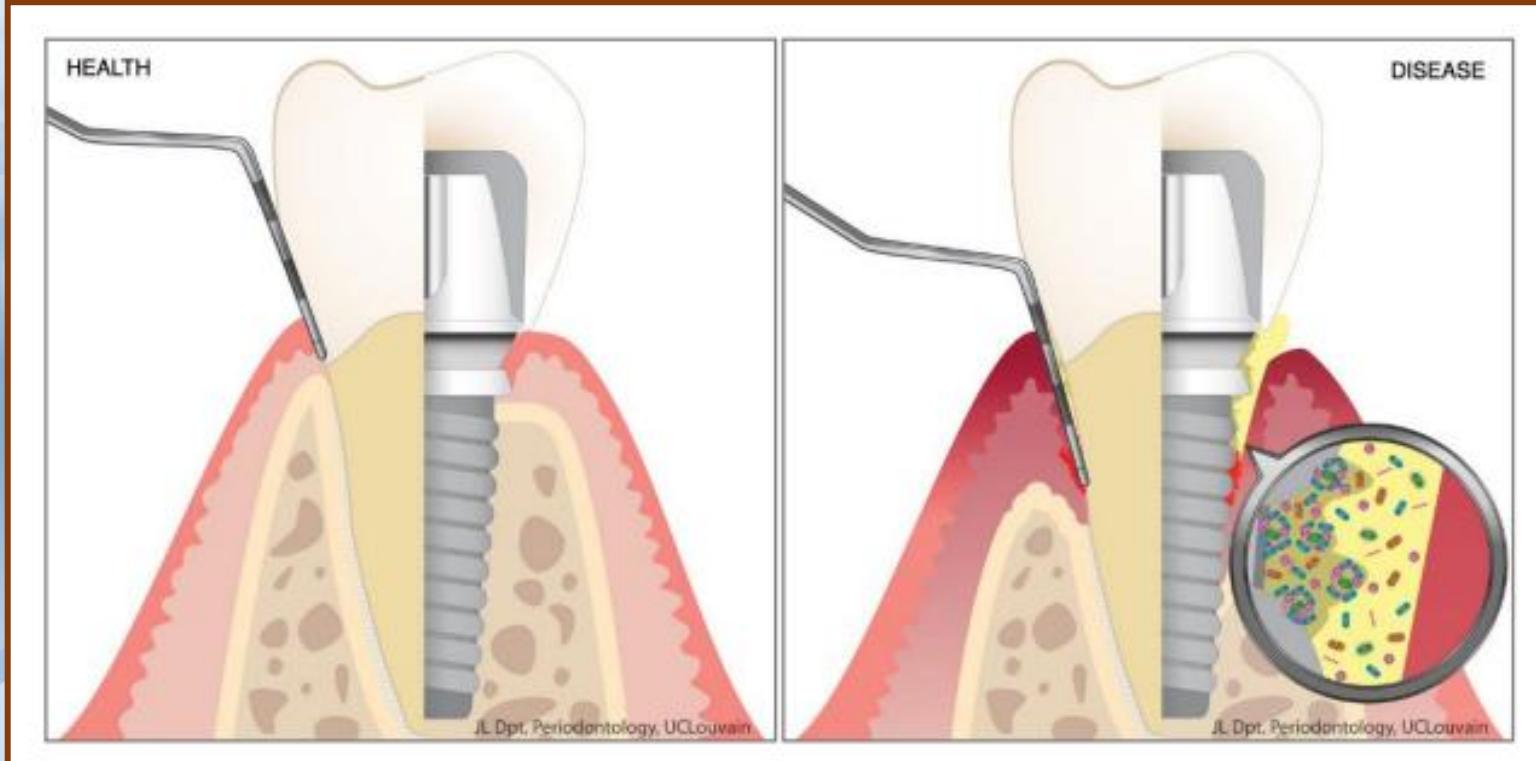
DISCUSSION



Shedding mechanism is a natural barrier

Millions of microbes present in the oral cavity, have the ability to form biofilms on biotic and abiotic surfaces using salivary proteins.

Now due to epithelial turnover, there is constant shedding of mucosal cells, due to which the chances of microbial adhesion are very low



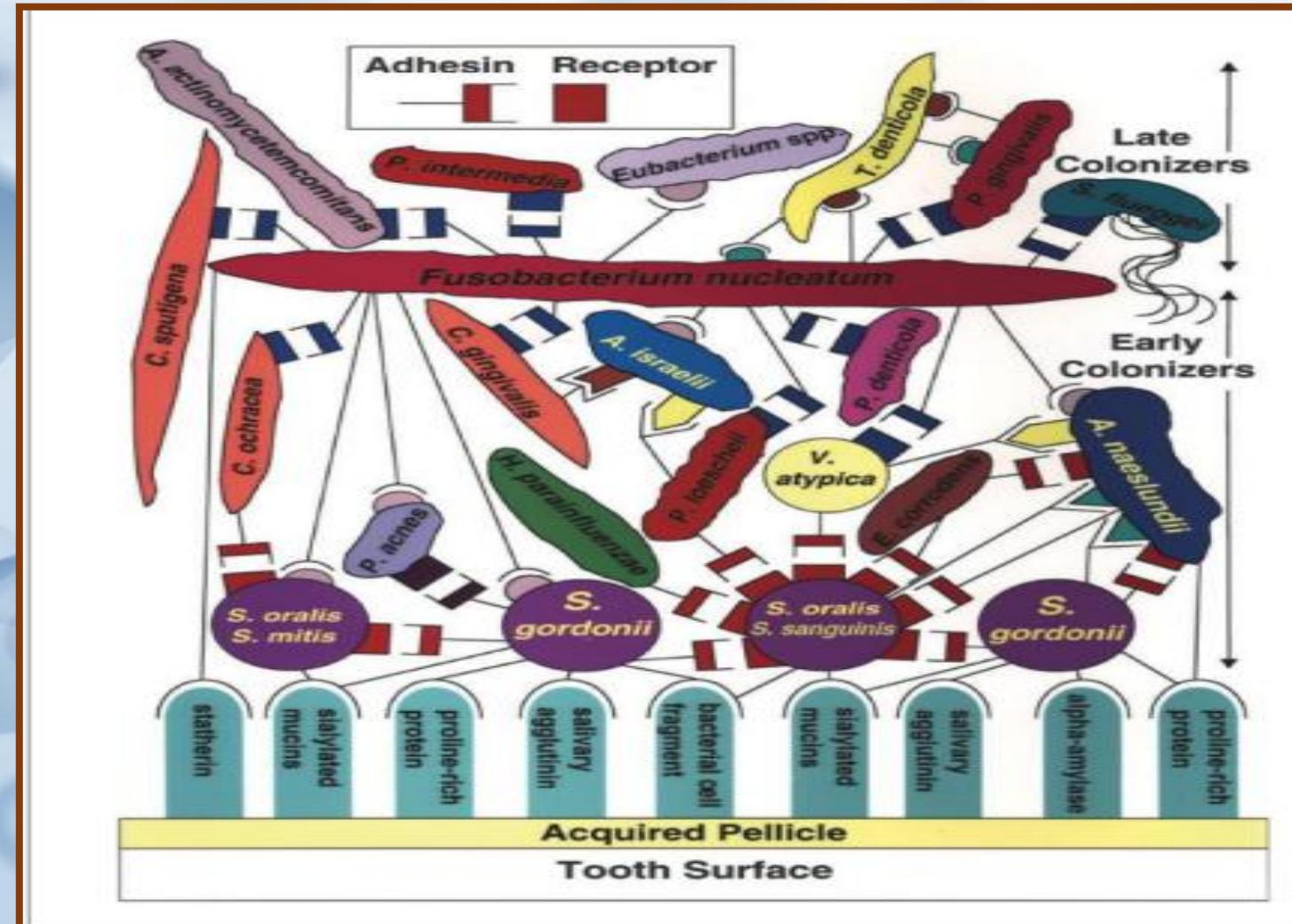
Periodontal/Peri-implant pocket formation, through local tissue destruction due to dysbiotic oral biofilm

However, this protective mechanism doesn't take place on a tooth/prosthesis/orthodontic appliance surfaces. The microbes start accumulating in the sulcus, which leads to pocket formation

The early colonizers in a biofilm are gram positive bacteria, predominantly cocci.

Later the population shifts progressively to gram negative bacteria, with the appearance of rods, filamentous and spirochetes.

Hence there is microbial coaggregation between different bacterial species via surface adhesins and receptors corresponding to intergeneric specific cell-to-cell recognition

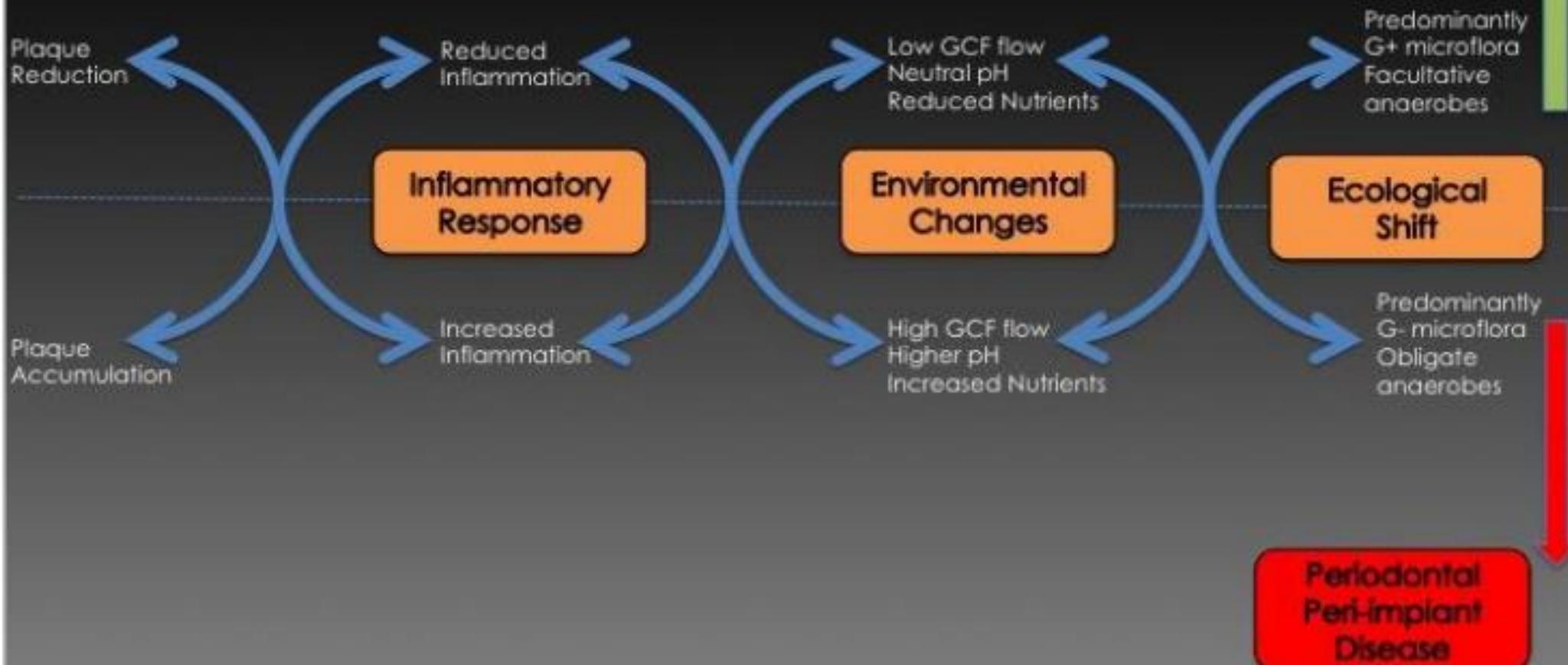


Bacterial co-aggregation in oral biofilm

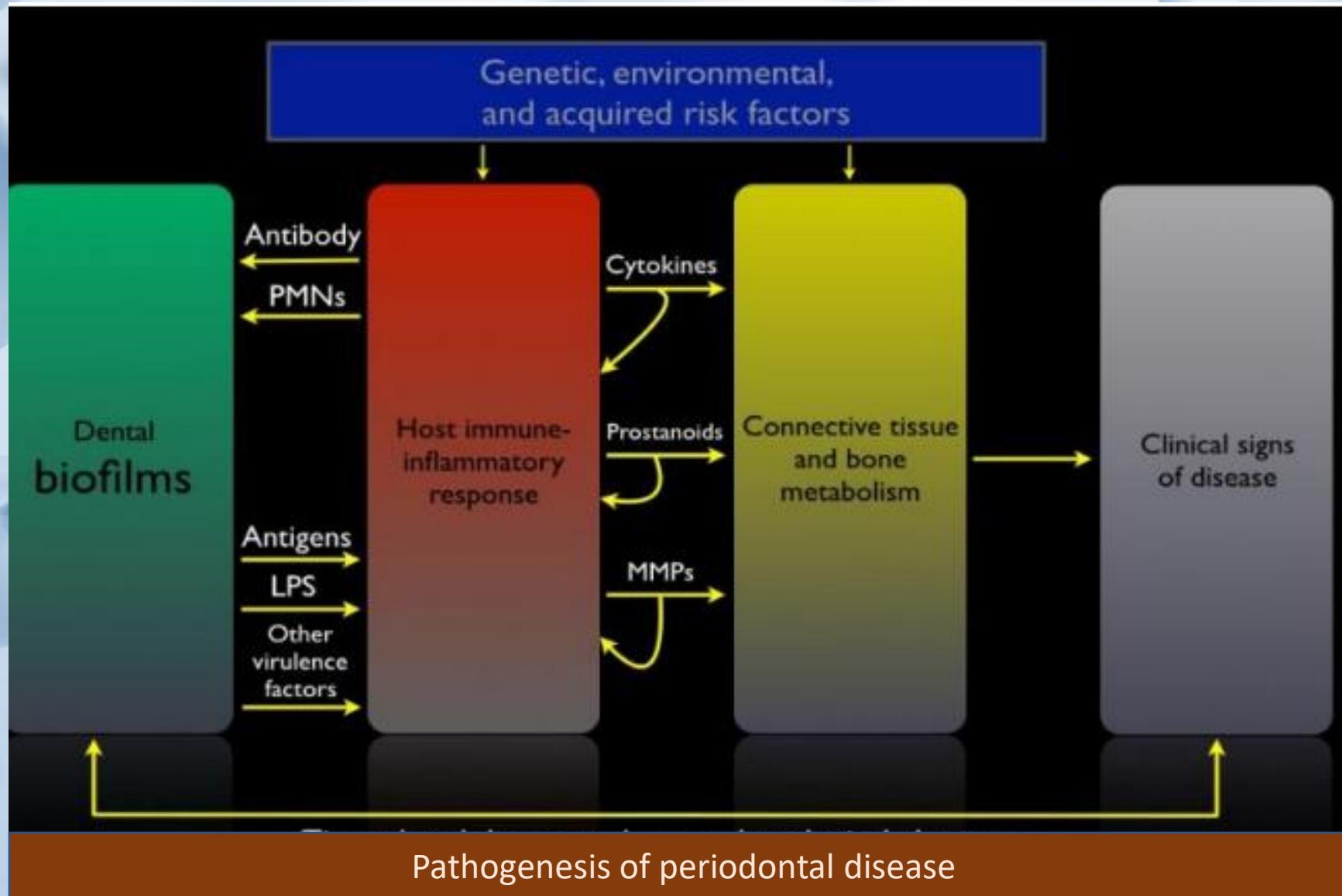
The primary colonizers, i.e. gram positive bacteria act as bridging species for the secondary colonizers and the late colonizers, through changes in the habitat

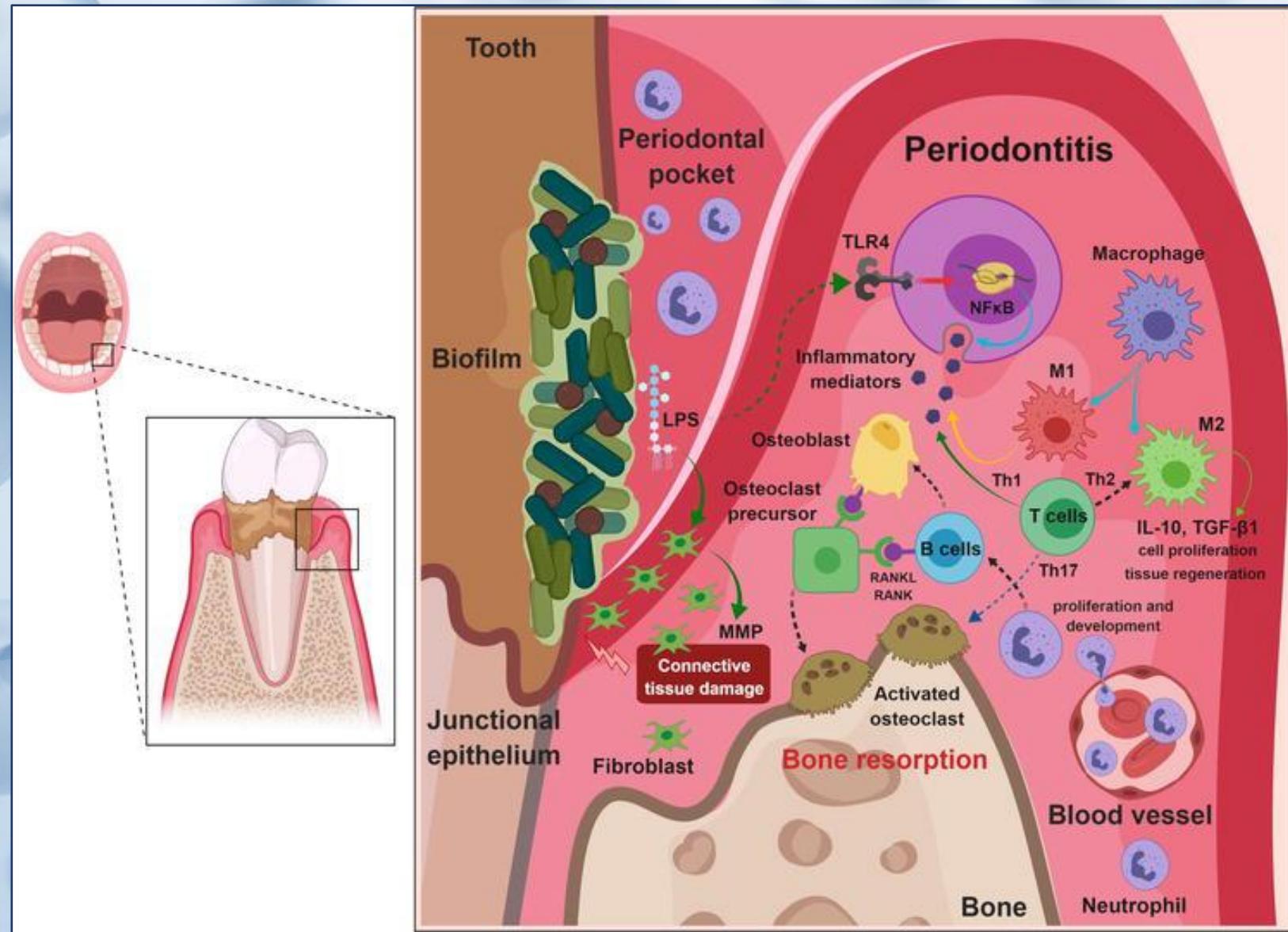
Ecological Plaque Hypothesis and Prevention of Periodontal/Peri-implant Diseases

Periodontal
Peri-implant
Health



At the molecular and genetic level...





José Luis Muñoz-Carrillo, Viridiana Elizabeth Hernández-Reyes, Oscar Eduardo García-Huerta, Francisca Chávez-Ruvalcaba, María Isabel Chávez-Ruvalcaba, Karla Mariana Chávez-Ruvalcaba and Lizbeth Díaz-Alfaro

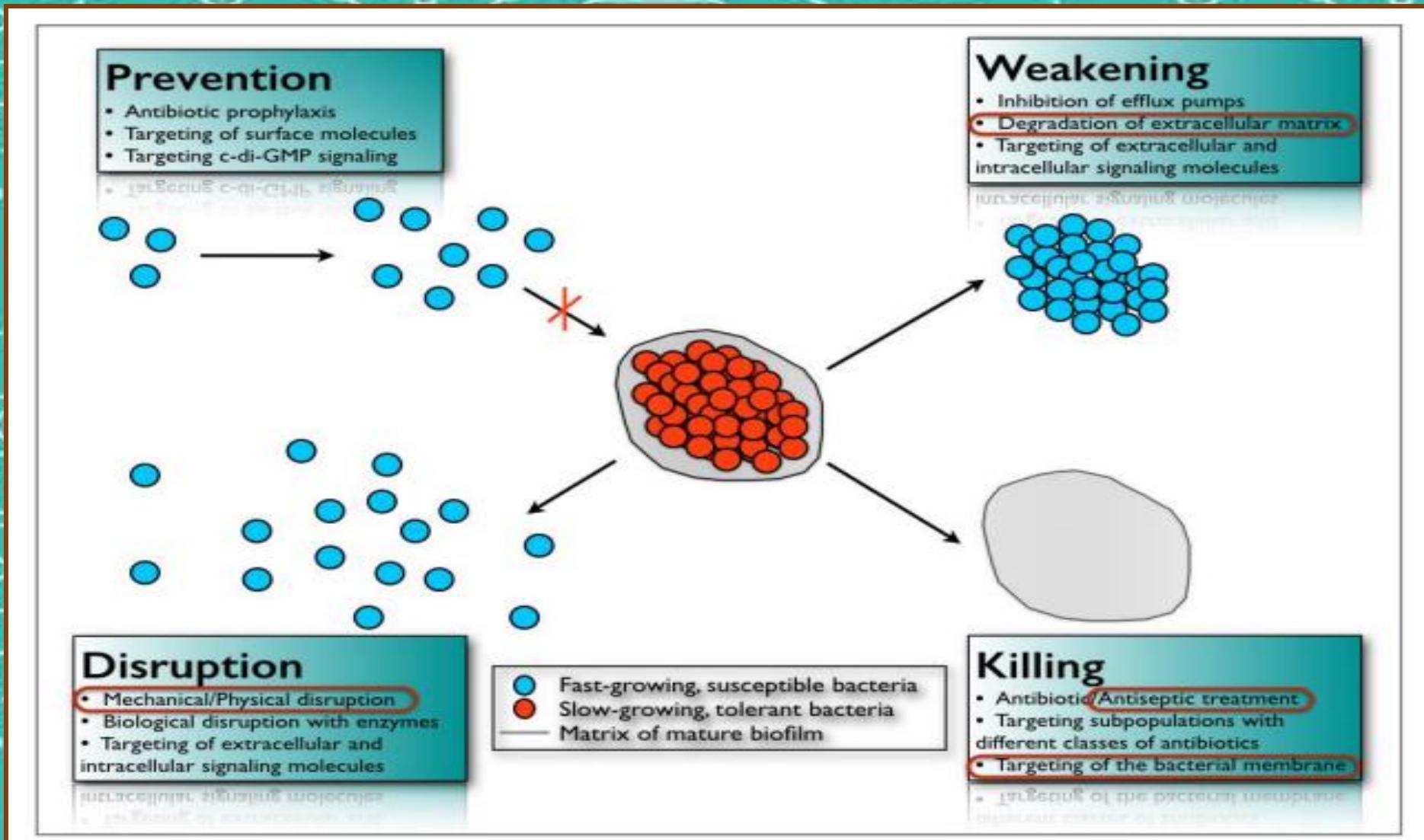
CONCLUSION

Control of subgingival plaque, to restore homeostasis between microbes and the host through oral hygiene instructions and non-surgical mechanical debridement; are the currently available clinical treatments.

However, for advanced lesions with probing depth $>/=7\text{mm}$ or for peri-implant lesions these treatments are less efficient.

Hence better, new strategies are needed.

RECENT ANTIBIOFILM STRATEGIES



REFERENCES

