Locations of Biofilms

- Intraorally as ‘dental plaque’
- Indwelling devices, organs, body parts
- Food processing facilities
- Drinking bowls, rocks in streams
- Dental unit waterlines
- Toilets and sink drains

Development of Dental Biofilm

- Acquired pellicle
- Initial bacteria – pioneers – adhere to the pellicle
- Increasing level of colonization
- Maturation

Structure of Biofilm

- Grouped communities of microbes
- Embedded in a matrix between subcolonies
- Fluid channels within matrix
- Differing pHs within different biofilm colonies

Biofilm Detachment and Dispersal

- Detachment
- Migration to other sites
- Attachment + colonization at new sites

Role of the Environment: Dental Biofilm

- Low pH favors Strep. mutans and lactobacilli
- Anaerobic favored by increase in pH

Biofilm, Fluoride and Sucrose

- Fluoride inhibits demin, promotes remin
- Fluoride can inhibit initial biofilm formation
- Changes in biochemical, microbiological aspects of biofilm observed with lower frequency sucrose use

Periodontal Disease

- Supragingival and subgingival plaque
- Bacterial complexes, pathogenicity
- Horizontal transmission
- Host response and the inflammatory cascade
- P. gingivalis competitive advantage over Aa
- Haem an essential growth factor, virulence regulator

Biofilm-related Diseases and Conditions

- Dental caries
- Periodontal disease
- Candidal infections
- Halitosis
- Oral-systemic associations
- Majority of human infections

Bacterial Adhesion

- Essential for formation of biofilm
- First reversible adhesion by pioneers
- Stronger adhesion with adhesion receptors

Bacterial Vitality

- CLSM + fluorescence studies in situ:
- Bacterial vitality increases with depth
- Voids with layers of live bacteria

Dental Caries

- Prevalence and caries experience by age group
- Risk factors and influencers – dental biofilm, microflora, diet, familial experience, past experience, genetics, lack of protective factors
- Biofilm differences?

Caries Microflora

- Primarily mutans streptococci
- In S-ECC cases, up to 40% of total flora

Caries Control

- ADA recommendations on in-office fluorides
- Home use fluorides
- Calcium and phosphate products
- Use of antimicrobial

Periodontal Therapy

- Initial therapy
- Adjunctive therapy
- Surgical therapy
- Periodontal maintenance
Candidal Infections
- Microorganisms and varied strains
- Virulence
- Biofilm structure

Biofilm Disruption and Removal: Mechanical
- Brushing and interdental cleaning
- Surfactant activity; rinsing
- Prophylaxis
- Nonsurgical Periodontal Therapy
- Microbubbling

Battling Biofilm
- Colonies are protected
- Some colonies are synergistic
- Structure restricts penetration of antimicrobials agents

Biofilm: Properties and Self-protection
- EPS matrix protects against host defenses
- Also prevents drying out of biofilm
- Betalactamase protects adjacent sensitive bacteria of other species
- Synergistic bacteria
- Cell-to-cell signaling
- Genetic reservoirs and gene transfer between bacteria

Biofilm: Sharing of Information
- Quorum Sensing
  - Cell-to-cell communication
  - autoinducers involved gene expression
  - Responsible for resistance to stress and changes in biofilm cellular behavior
- Sharing of metabolized compounds
- Sharing of genetic information
- Bacterial electro-conductive nanowires (pili)

Combatting Biofilm: Potential and Future Strategies
- Surface treatments and novel particles
- Photocactivity
- Enzymatic dissolution of EPS/shell layer
- Interfering with signalling
- Modulation of dental biofilm
- Environmental changes
- Gene targeting
- Neutraceuticals and Probiotics
- Develop anti-biofilm defenses

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