Oral Health and Nutrition

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No Disclosures or conflicts of interests

Agenda

American Dental Association guidelines

- Antibiotic Prophylaxis
- Anticoagulation Management

Oral Microbiome
Oral Health and Systemic Link
Oral History and Nutrition
Recommendations

Antibiotic prophylaxis indications

- Compared with previous recommendations, there are currently relatively few patient subpopulations for whom antibiotic prophylaxis may be indicated prior to certain dental procedures.

- In patients with prosthetic joint implants, An ADA systematic review states, “In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection.”

- According to the same article, for patients *with a history of complications associated with their joint replacement surgery* who are undergoing dental procedures that *include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered after consultation with the patient and orthopedic surgeon;* in cases where antibiotics are deemed necessary, it is most appropriate that the orthopedic surgeon recommend the appropriate antibiotic regimen and, when reasonable, write the prescription.

Management of patients with prosthetic joints undergoing dental procedures

Clinical Recommendation:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are *not* recommended prior to dental procedures to prevent prosthetic joint infection.

For patients with a history of complications associated with their joint replacement surgery who are undergoing dental procedures that include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered after consultation with the patient and orthopedic surgeon.* To assess a patient's medical status, a complete health history is always recommended when making final decisions regarding the need for antibiotic prophylaxis.

Clinical Reasoning for the Recommendation:

- There is evidence that dental procedures are not associated with prosthetic joint implant infections.
- There is evidence that antibiotics provided before oral care do not prevent prosthetic joint implant infections.
- There are potential harms of antibiotics including risk for anaphylaxis, antibiotic resistance, and opportunistic infections like *Clostridium difficile*.
- The benefits of antibiotic prophylaxis may not exceed the harms for most patients.
- The individual patient's circumstances and preferences should be considered when deciding whether to prescribe prophylactic antibiotics prior to dental procedures.

ADA Center for Evidence-Based Dentistry™

* In cases where antibiotics are deemed necessary, it is most appropriate that the orthopedic surgeon recommend the appropriate antibiotic regimen and when reasonable write the prescription.

Sollecito T, Abt E, Lockhart P, et al. The use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints: Evidence-based clinical practice guideline for dental practitioners — a report of the American Dental Association Council on Scientific Affairs. JADA. 2015;146(1):11-16.

Antibiotic prophylaxis indications

- For infective endocarditis prophylaxis, American Heart Association guidelines support premedication for a relatively small subset of patients. This is based on a review of scientific evidence, which showed that the risk of adverse reactions to antibiotics generally outweigh the benefits of prophylaxis for many patients who would have been considered eligible for prophylaxis in previous versions of the guidelines. Concern about the development of drug-resistant bacteria also was a factor.

- Infective endocarditis prophylaxis for dental procedures should be recommended only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis . For patients with these underlying cardiac conditions, prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.

Table 2: Underlying conditions for which antimicrobial prophylaxis is suggested (before certain dental procedures)[19]

Prosthetic cardiac valve or material

- Transcatheter implanted prosthetic valves
- Annuloplasty, rings, or clips
- Left ventricular assist devices or implantable heart

Previous, relapse, or recurrent infective endocarditis

Congenital heart disease [CHD]

- Unrepaired cyanotic congenital CHD (including palliative shunts, conduits)
- Completely repaired defect with prosthetic material/device within 6 months after procedure
- Repaired CHD with residual defects at/or adjacent to the site of prosthetic material
- Surgical or transcatheter pulmonary artery valve or conduit placement

Cardiac transplant recipients who develop cardiac valvulopathy

Recommended Antibiotics

Patient group	Antibiotic	Dose (single, 30–60 min before procedure)	
		Adults	Children
Able to take oral medication	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin **OR** Cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillins or ampicillin and able to take oral medication	Cephalexin[a,b] **OR** Clindamycin **OR** Azithromycin or clarithromycin	2 g 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone[b] **OR** Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM or IV 20 mg/kg IM or IV

Note: IM = intramuscular, IV = intravenous.

[a]Or other first- or second-generation oral cephalosporin at equivalent adult or pediatric dose.

[b]Cephalosporins should not be given to a patient who has a history of anaphylaxis, angioedema or urticaria with penicillins or ampicillin.

Hematologic considerations

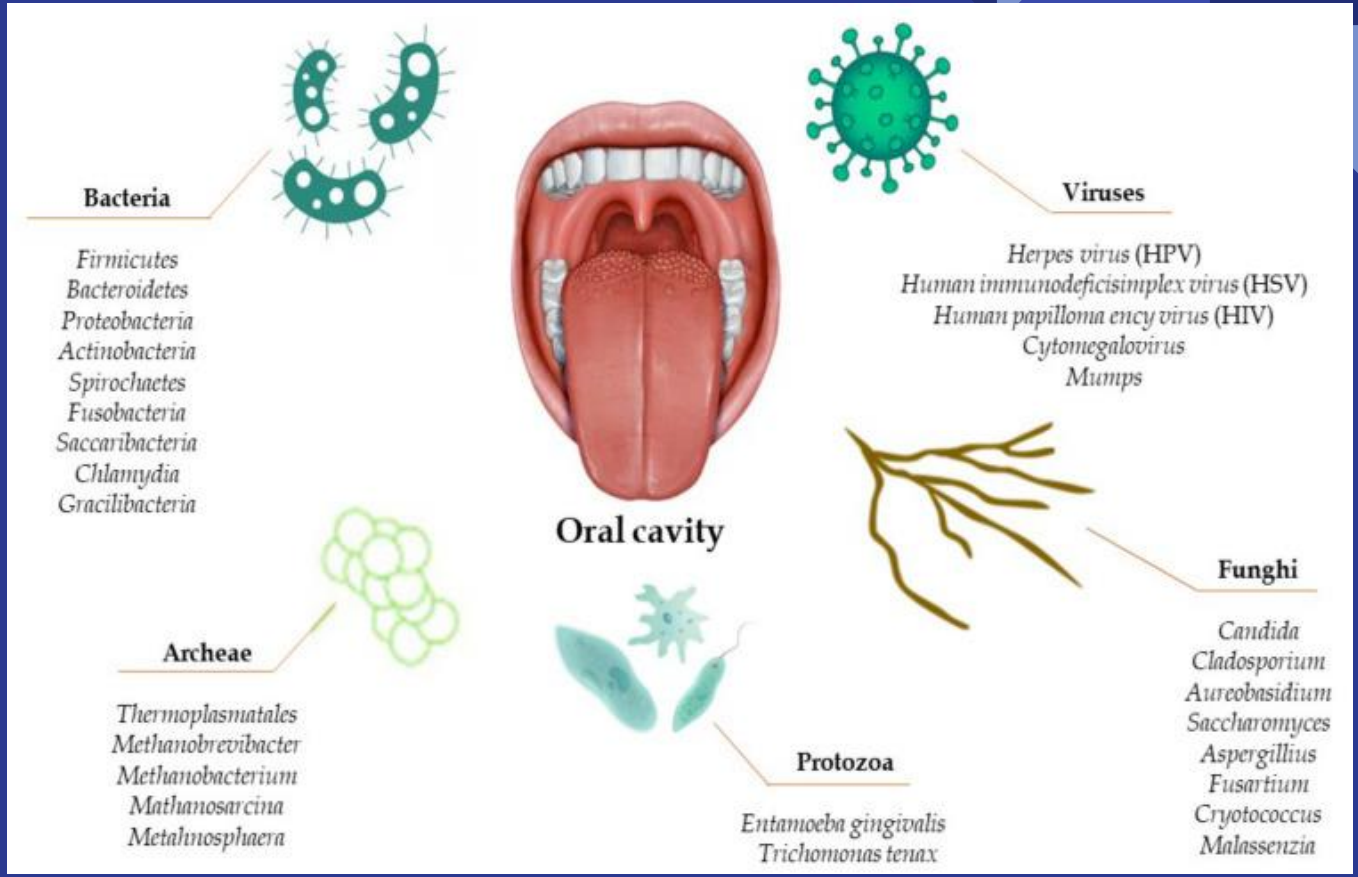
Hematological Conditions: Medications and Lab Tests

- Anti-platelet medications:
  - Aspirin, Plavix, Effient, etc.
- Anti-coagulation medications:
  - Warfarin (coumadin): Vit K antagonist, Pradaxa (direct thrombin inhibitor), Eliquis and Xarelto (factor Xa inhibitor), etc.
- Obtain blood test before treatment:
  - PT & PTT & INR
  - Platelet count, Bleeding time

Oral Microbiome

Oral Microbiota

Human oral cavity hosts the second most plentiful and diverse microbiota after the gastrointestinal tract - over 700 different types



The Commensals - Good guys

- L. acidophilus
- L. reuteri
- L. brevis
- L. casei Shirota
- L. salivarius WB21
- Bacillus subtilis
- L. rhamnosus strains GG and LC705

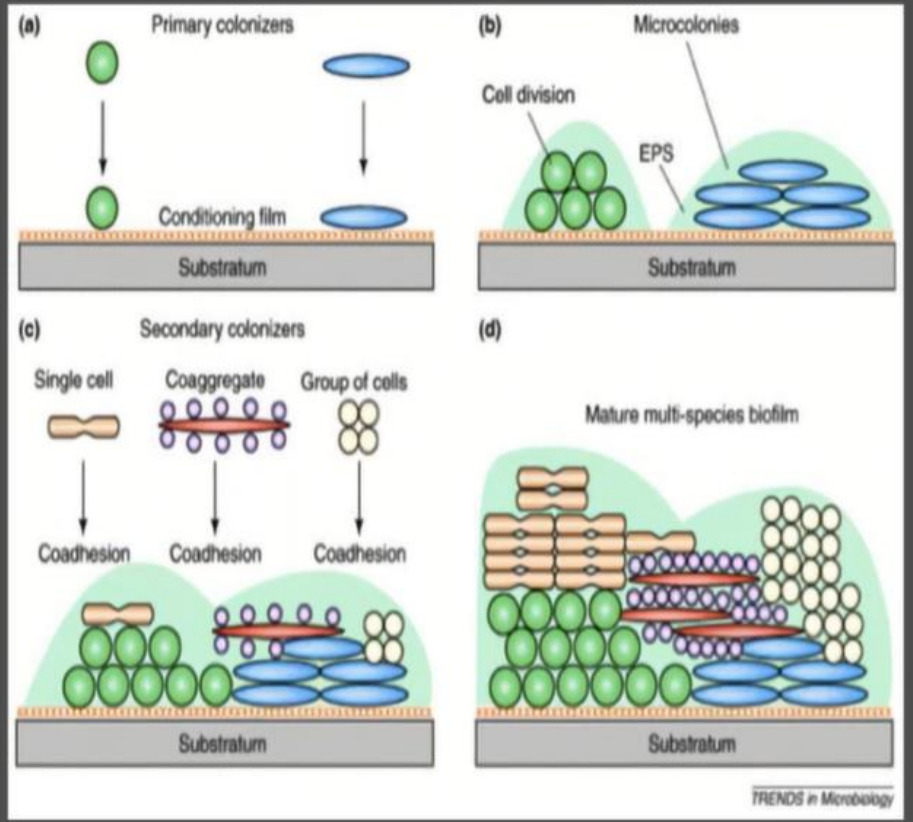
Found in fermented foods such as yogurt and sauerkraut

Pathogenic

- P gingivalis
- T forsythia
- Treponema denticola
- S mutans

Biofilm formation

- Primary colonizers
- Secondary colonizers
- Matrix formation/calcification
  - Peptidoglycan/ polysaccharide
  - Saliva minerals
- Chemotaxis
- Equilibrium of bacterial ecosystem
- Shedding/spreading



Oral Microbiome

Microbiota is helping us train the immune system, digest food and maintain health.

Constant state of flux with changes in environment, food and drink

Oral microbiome is like a garden - plants vs weeds

Local consequences of dysbiosis

Periodontitis

- Progressive destruction of the periodontal ligament and alveolar bone with inflammation of gingiva
- Highly prevalent disease, affecting around 50% of the population
- Low grade chronic infection - reservoir of typically gram negative anaerobic bacteria

Local consequences of dysbiosis

Tooth decay

- S.Mutans and a complex variety of bacteria produce an acidic environment that reduces PH, decalcify teeth and ingress to cavitate teeth.

Halitosis

- Bacteria produce VSC (volatile sulfur compounds) causing bad breath

Oral Health and Systemic Link

Exploring the Oral Systemic link

Three primary mechanisms linking oral infection to systemic pathology have been identified

1. Metastatic infection - live microorganisms enter the bloodstream and cause bacteremia. Eg after a dental surgery 100%, 70% after periodontal surgical scaling
   - Possible non-oral diseases - Subacute infective
   - endocarditis, acute bacterial myocarditis, brain abscess, cavernous sinus thrombosis, sinusitis, lung abscess/infection, Ludwig's angina, orbital cellulitis, skin ulcer, osteomyelitis, prosthetic joint infection

2. Metastatic injury - This occurs from the effects of circulating oral microbial toxins - exotoxins by live bacteria and endotoxins byproducts of dead microorganisms

- Possible non oral diseases - Cerebral infarction, acute myocardial infarction, abnormal pregnancy outcome, persistent pyrexia, idiopathic trigeminal neuralgia, toxic shock syndrome, systemic granulocytic cell defects, chronic meningitis

3) Metastatic inflammation caused by immunological injury induced by oral microorganisms

- Possible non oral diseases - Behçet's syndrome, chronic urticaria, uveitis, inflammatory bowel disease, Crohn's disease

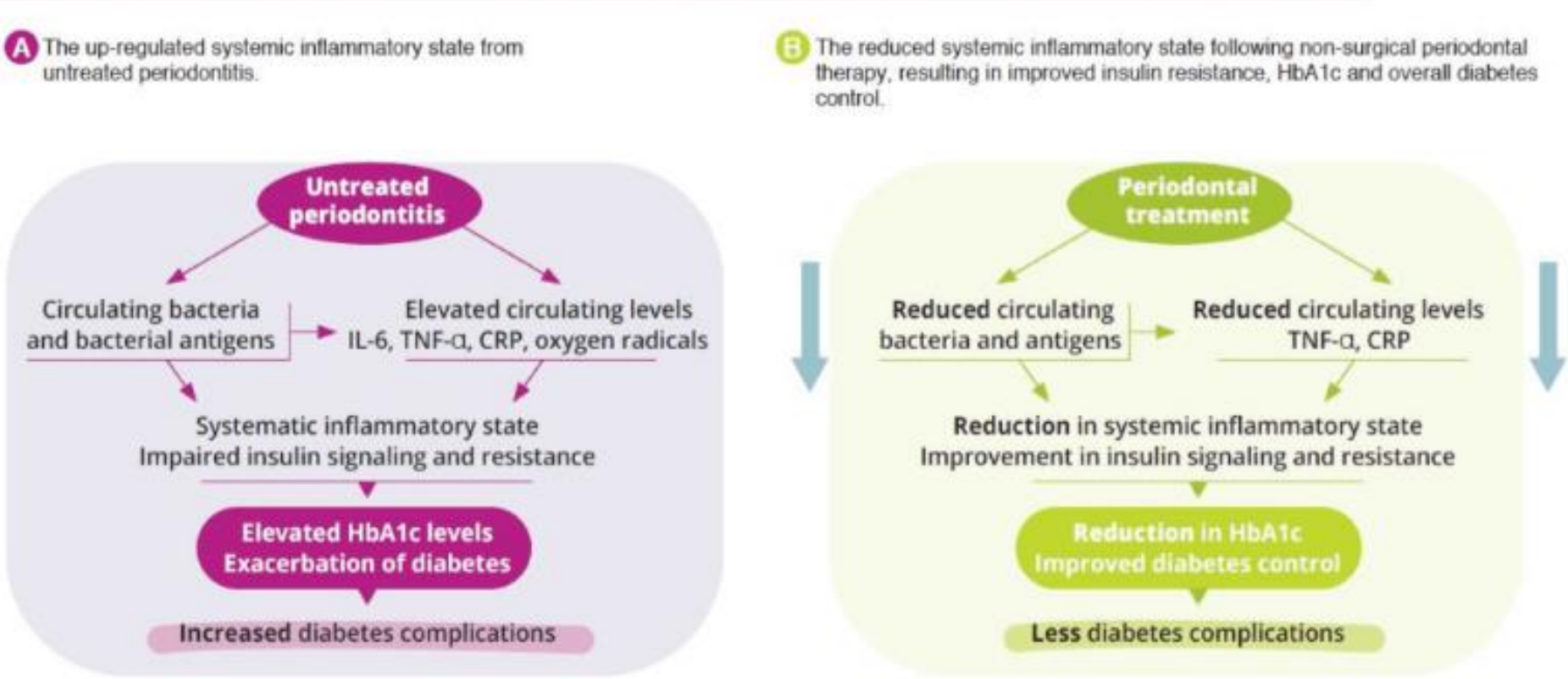
Systemic Connections of Periodontitis
Diabetes

- Periodontitis is the sixth Major Complication of diabetes

- 2-3 times increased risk of both diabetes and periodontitis bidirectionally
- Improving dental health can reduce HbA1C 0.3 - 0.4% within 4 months of treatment

FIGURE • 2

The mechanistic association between periodontitis and diabetes, and the impact of non-surgical periodontal therapy on diabetes control. Reproduced from Preshaw P, Bissett S. Periodontitis and diabetes. *Br Dent J* 2019; 227(7): 577–584.



- CRP = C-reactive protein
- HbA1c = glycated haemoglobin
- IL-6 = interleukin-6
- TNF-α = tumour necrosis factor-α

Systemic Connections of Periodontitis
Chronic Kidney Disease

Porphyromonas gingivalis LPS has been detected in various *endothelial cells*; it triggers induction of increased reactive oxygen species (ROS), followed by NF-kB-induced inflammation, polynuclear adhesion, and cell death.

Mortality rates of patients with CKD increased from 32%to 41% when periodontitis was present

Improved oral hygiene was associated with decreased occurrence of CKD in a nationwide retrospective cohort study . The frequency of brushing had a positive impact on GFR

Systemic Connections of Periodontitis
Alzheimers Dementia

- P. Gingivalis identified in the brain of patients with Alzheimers
- LPS on the surface of gram negative bacteria have been implicated in crossing the blood brain barrier promoting chronic neuroinflammation
- Leading to amyloid plaque
- There is a two-way relationship between chronic periodontitis and Alzheimer's disease. Due to limited mobility and poor oral hygiene in patients with Alzheimer's disease, it promotes the accumulation of periodontal tissue inflammation and eventually leads to tooth loss. Because the loss of teeth affects the patient's eating and nutritional status, it may worsen the patient's memory and other nervous system functions

Systemic Connections of Periodontitis
Obesity

Oral bacteria contribute to inflammation resulting in adipose tissue deposition

Oral bacteria also impact taste perception

- Building a physical biofilm barrier
- Reduction in access to taste receptors
  - Sweet
  - Salty
  - Sour

The interaction of oral bacteria with oral taste cells and receptors can regulate food preference

Systemic Connections of Periodontitis
Cardiovascular Disease

The primary microbial implications are endothelial dysfunction and the promotion of atherosclerosis in cardiovascular cells.

Oral bacterial infections increase the levels of C-protein has an important correlation with the development of atherosclerotic vascular disease

Streptococcus sanguis is an early colonizer of dental plaque, with the highest detection rate in the endocardium of patients, and is closely related to the inflammatory process of endocarditis

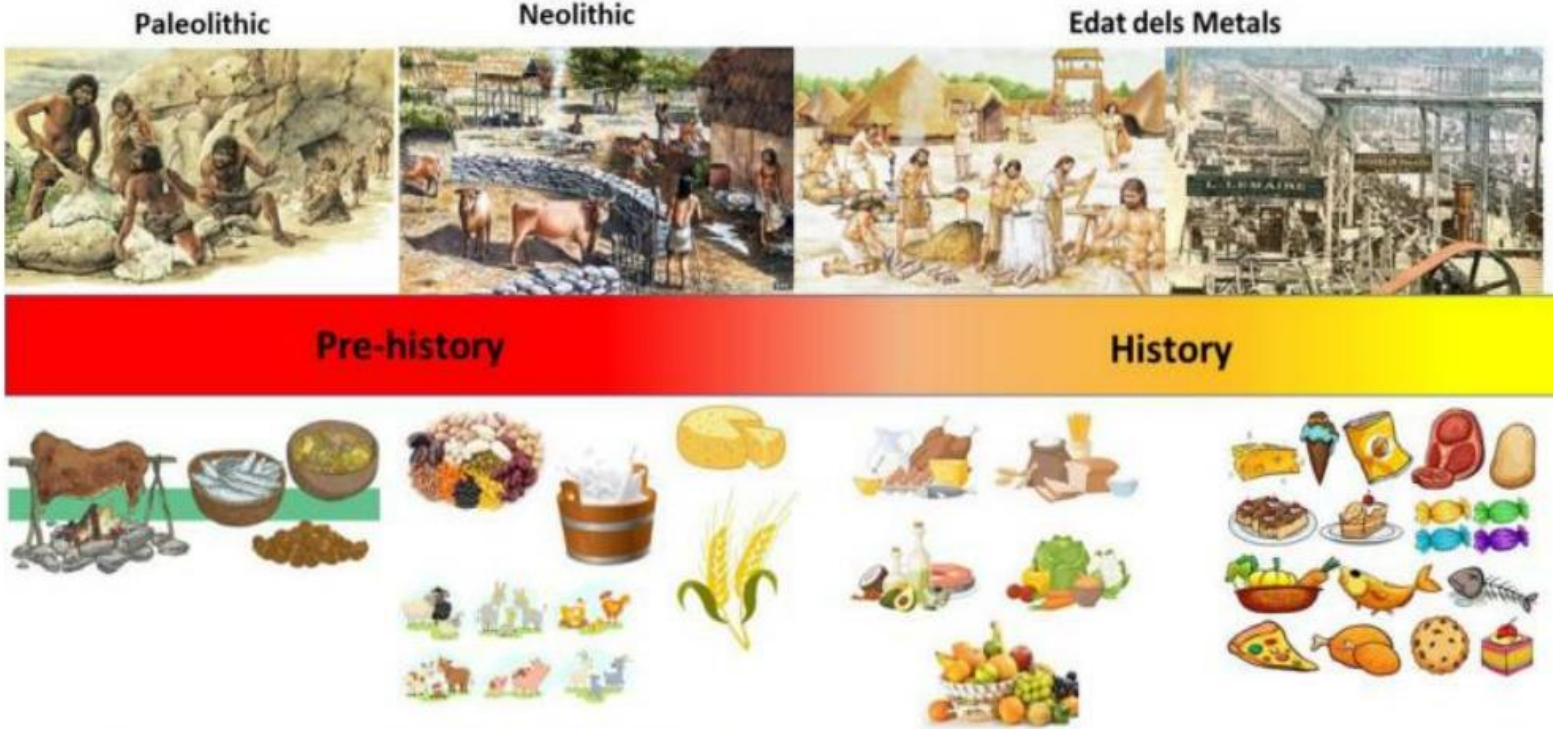
After the treatment of periodontitis, C-reactive protein, which is an indicator of the systemic inflammatory state, was significantly reduced in the patient's serum

History of Oral Diet and Disease

Study on dental tartar to determine microbiota and DNA along different times periods of human history

Evaluated 3 distinct time periods - Paleolithic society, Neolithic society and modern day society

Evaluated microbiome, food habits and disease


Paleolithic
Neolithic
Edat dels Metals
Pre-history
History
Evolution Oral Microbiome
Clostridia
Veillonellaceae
Ruminococcaceae
Fusobacterium, Leptotrichiaceae
Porphyromonas, Actinomyces
Stenotrophomonas

Key Findings

- The transition from hunter-gatherer to agrarian lifestyles introduced dairy products, refined carbohydrates, vegetable oils, and alcohol into the human diet, which are staples of the modern diet

- Compared to the proportions and species of oral microbes found in hunter-gatherer plaque samples, samples from agricultural populations from the Neolithic onwards are predominated by caries-associated species

- Differences amongst men and women in hunter gatherer societies implicated diet and their oral health - honey and tobacco

- It was hypothesized that consumption of fibrous, uncultivated tubers by bush dwellers offered increased masticatory challenge that was effective in helping to interrupt plaque formation by mechanically abrasion.

Key findings

- Diversity of oral microbiome dropped as did their resilience perhaps explaining an increase in disease.
- Worsening dental health along the timeline from hunter gatherers to modern day western diet due to less fibrous, more processed sugar rich foods.

Modifiable factors

- Diet and Lifestyle
- Breathing and development
- Oral hygiene practices
- Smoking

Healthy Biome

- Eat whole food, plant based diet - increased mastication better for disruption of biofilm
- Add nitrate to your diet - Beetroot juice increases levels of oral aerobic nitrate reducing bacteria combating periodontal anaerobic pathogens
- Reduce sugar intake - immediate food source for bacteria- quick source of acid and VSC's
- Take more complex carbohydrates -not easily fermentable
- Eat more fermented foods - sauerkraut, kimchi, kefir - probiotic advantage
- Omega 3 fatty acids (walnuts) - known to improve gum health
- Consume enough water -Optimal saliva flow, Salivary proteins and minerals are 1st line of defense against cariogenic bacteria
- Probiotics - Combating the acidity produced by pathogenic bacteria by introducing alkalinity. Administration of arginine alone has been shown to be effective at inhibiting the initiation of dental caries.
- Reduce sulfur containing foods such as beef, fish and eggs- VSC - halitosis and gingivitis

Orofacial structure development, Breathing & Function

Ever wondered why caveman didn't need braces?

The prevalence of malocclusion in US adults is over 60%

The size of our jaws have become smaller leading to more malocclusions - Why?

A primary cause is a lifestyle that reduces the amount of chewing . Since industrialization, children are no longer weaned to the relatively tough foods their parents eat. Instead, they are switched to soupy baby foods.

Role of breastfeeding and jaw muscles

Indoor allergens such as dust mites and formaldehyde concentrate create stuffy noses, and that leads to mouth breathing. That, in turn, bypasses the natural air cleaning, warming, and humidifying functions for which the nose was designed.

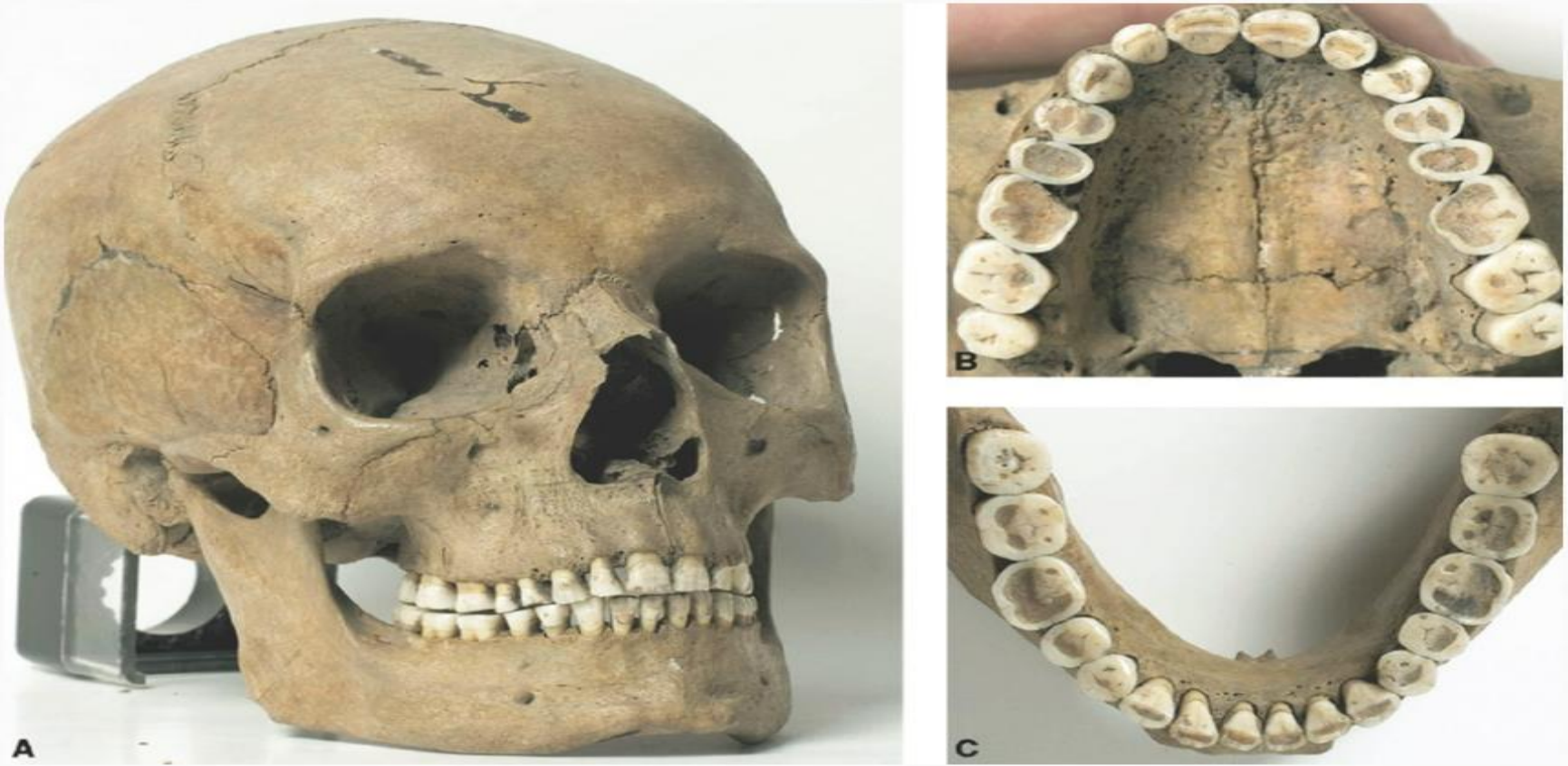


Image 4. Skull of a pre-industrial human being with a spacious jaw and all molars fully in place. People before industrial civilization did not get impacted wisdom teeth. Male skull shown is from a 14th century church in Oslo. Note lack of crowding and absence of malocclusion. A, Skull with jaws; B, upper jaw arch; C, lower jaw arch. (Photos courtesy of *American Journal of Orthodontics and Dento-facial Orthopedics*)

Mouth Breathing changes the pressures of the air flowing through the nose and mouth, hindering jaw development. This phenomenon was documented long ago by experiments in which blocking the noses of rhesus monkeys produced great distortions in their jaws.

This in turn affects reduction in airway space

Mouth Breathing and its effect on drying out the mouth causing gingival inflammation and change in the microbiota towards periodontal disease.

Obstructive sleep apnea - insufficient airway space

Sleep apnea also appears to generate mental problems, including lowered IQ, shortened attention span, and difficulties with memory

Tips to help with better breathing and development

GOPex exercises (Good Oral Posture Exercises)

Practice meaningful chewing to build jaw musculature. Try to chew 15-20x with each mouthful - you may have to build up to this.

Learn to swallow with your teeth together

Close your mouth when not in use

Use your nose for breathing even when exercising

Other practices

Rest with your tongue lightly on the roof of your mouth with your teeth lightly touching.

Chewing gum for 30mins /day is good jaw exercise (xylitol gum). Do it with your lips closed and breathe only through your nose. Make sure to chew on both sides and keep your teeth together as you swallow.

If you have a child, ideally breastfeed for at least a year and during that time try not to bottle feed. Lightly pinch an infant's lips together after nursing to encourage nose breathing. Avoid pacifiers until weaning is complete. Teach kids to keep their mouths closed when not eating or talking

Oral hygiene

A toothbrush is meant to clean not innoculate. Encourage daily brushing BID *and* cleaning of toothbrush well and stored in a clean area or with a cover. Flossing BID.

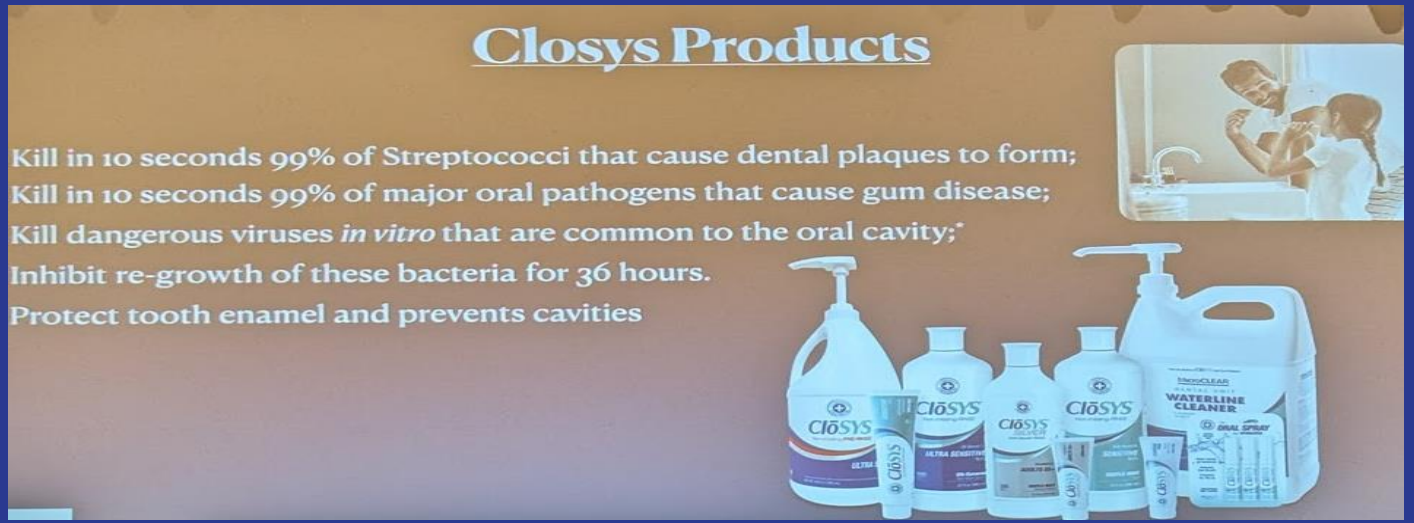
Change brush out every 3 months, consider an electric toothbrush - better disruption of biofilm

Toothpaste - toothpaste formulations have been developed formulated to shift oral ecology. Zendium contains proteins designed to promote oral health and limit disease-associated organisms.

Oral hygiene - continued

Mouthwashes in general contain alcohol, hydrogen peroxide, or chlorhexidine, or a mixture of these active ingredients - variable success. Avoid alcohol based rinses

Closys - OTC



ClōSYS Ultra Sensitive Rinse

Un-flavored for **Ultra Sensitive** Mouths

- **Great for sensitive mouths, oral sores and dry mouth.**
- **Doesn't sting, stain or burn the mouth or teeth.**
- **Also recommended for cancer patients.**

- Eliminates Bad Breath - not a cover up.
- The only Unflavored Rinse on the market.
- Comes *with Flavor Con*trol™ Option for those who like to add their own level of taste.
- Triclosan- Free, Alcohol-Free, Sulfate-Free, Gluten-Free

Oral hygiene

Chewing xylitol gum - Known to reduce cariogenic bacterial concentration. Xylitol contains zero fructose and has negligible effects on blood sugar and insulin.

Smoking

Smokers demonstrated an early pathogenic colonization that led to sustained pathogen enrichment with periodontal and respiratory pathogens, eliciting immune response

The ability of the subgingival microbiome to “reset” itself following episodes of disease is decreased in smokers, thereby lowering the resilience of the ecosystem and decreasing its resistance to future disease

Concluding statements - The future

- Dysbiosis in the oral microbiome is the primary driver for local and systemic disease onset and progression is mediated by highly modifiable risk factors can affect change towards health.

- Future treatment modalities may include individual assessment of the microbiome via genomics or salivary testing for early detection of subjects at high risk for diseases.
- A need for more collaboration between dental and health providers in addressing local oral health and systemic disease - Discussions with patients on follow up,s networking with local providers

Concluding statements - The future

Adopting dietary changes to restorating a healthy microbiota and improved resilience to disease - local and systemic.

Encouraging breathing and orofacial posturing exercises to reduce mouth breathing

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Thank you for your attention!

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