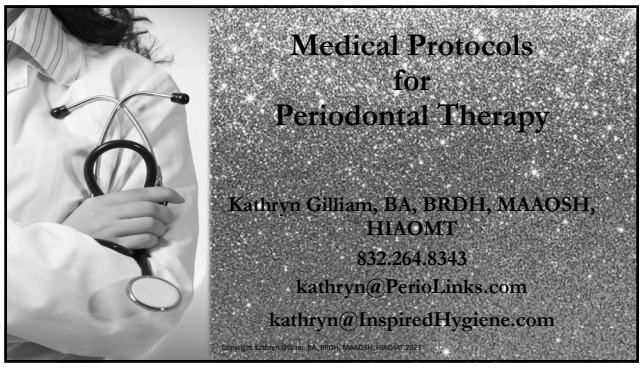


1

Prevalence of Chronic Disease

https://www.nidcr.nih.gov/news-events/2020/turning-back-clock-gum-disease

2

Mortality Affected by Oral Health

Nine-year study Journal of Aging Research
5611 older adults

People who never flossed 30% higher death rate

Never brushing at night increases mortality risk by 25%

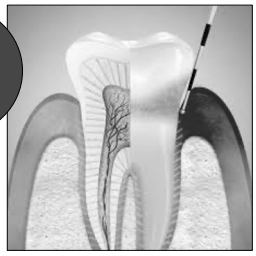
People who didn't visit dentist in previous year **50% higher mortality** rate than those who go 2x/year

Annila Paganini-Hill, Stuart C. White, Kathryn A. Atchison, "Dental Health Behaviors, Dentition, and Mortality in the Elderly: The Leisure World Cohort Study", *Journal of Aging Research*, vol. 2011, Article ID 156182, 12 pages, 2011. https://doi.org/10.4061/2011/156182

3

Prevalence of Gingivitis

93.9% of adults 18-90 years of age

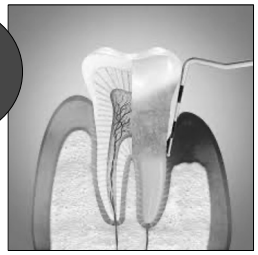


Am J Dent. 2010 Feb;23(1):5-13.Prevalence and severity of gingivitis in American adults.

4

Prevalence of Periodontitis

The AD Estimates 45.2% adults 30-79 years of age



J Dent Res. 2016 May;95(5):515-22. doi: 10.1177/0022034516629112. Epub 2016 Feb 4.Predicting Periodontitis at State and Local Levels in the United States.

5

The Links

Association:
At increased risk for systemic disease but PD does not *cause* the systemic disease

AD

Causal Relationship:
PD *caused* or *initiated* the systemic disease

CVD

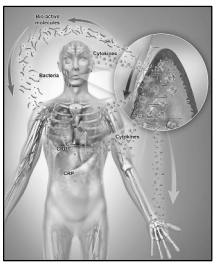
Bi-directional Relationship:
PD *contributes to* the systemic condition and the systemic disease *contributes to* the periodontal disease

DM

Winning L, Linden GJ. Periodontitis and Systemic Disease: Association or Causality? *Curr Oral Health Rep.* 2017;4(1):1–7. doi:10.1007/s40496-017-0121-7

6

Inflammation



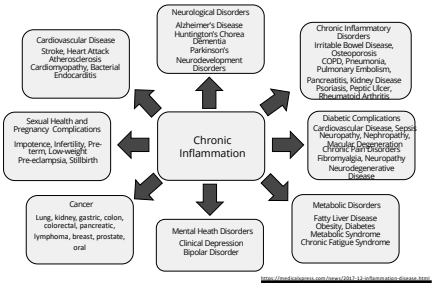
Acute: body's natural defense triggered in response to toxins, injury or invasion by pathogens. **Pro-inflammatory cells** signal white blood cells to clear infection and damaged tissues. **Anti-inflammatory cells** signal healing process to begin.

Chronic: Immune system stuck in "on" position. White blood cells are signaled, and **a continued avalanche** of cells being released without ever being "turned off."

Pahwa R, Jialal I. Chronic Inflammation. [Updated 2019 Jun 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK493173/

7

Inflammation in Chronic Disease



https://medicalxpress.com/news/2017-12-inflammation-disease.html

8

Polymicrobial Synergy and Dysbiosis

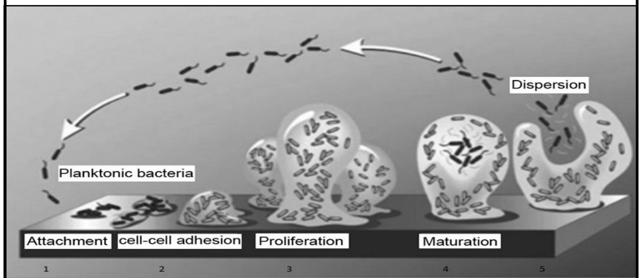
Old research focused on **DNA** analysis, which reveals the **identity** of the bacteria

New research focused on analysis of bacterial mRNA, which identifies **metabolic activity**

Shaikh HFM, Patil SH, Pangam TS, Rathod KV. Polymicrobial synergy and dysbiosis: An overview. *J Indian Soc Periodontol*. 2018;22(2):101–106. doi:10.4103/jisp.jisp_385_17

9

Stages of Biofilm Formation



10

Why non-surgical periodontal therapy alone is not enough to fully heal patients

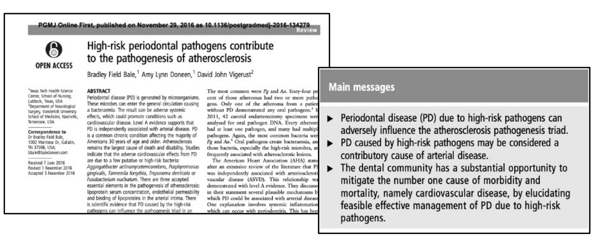
In conventional methods of plaque biofilm debridement, periodontal pockets will still contain residual biofilm, which consists of harmful pathogens, dead tissue, and a combination of blood and inflammatory cells.

There is strong evidence that molecular components of this bioburden remain despite rigorous standard prophylaxis using high-speed ultrasonic scalers and antibiotics.

These remaining residual biofilm components continue to trigger the host's immune response and perpetuate the underlying disease.

11

Periodontal Pathogens Causal for Atherosclerosis


PGMJ Online First, published on November 29, 2016 as 10.1136/postgradmedj-2016-134279

Review

OPEN ACCESS

High-risk periodontal pathogens contribute to the pathogenesis of atherosclerosis

Bradley Field Bale,[1] Amy Lynn Doneen,[1] David John Vigerust[2]

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[2]Department of Neurological Surgery, Vanderbilt University School of Medicine, Nashville, Tennessee, USA

Correspondence to Dr Bradley Field Bale, 1002 Montrose Dr, Gallatin, TN 37066, USA; bbale@baledoneen.com

Received 7 June 2016
Revised 1 November 2016
Accepted 5 November 2016

ABSTRACT

Periodontal disease (PD) is generated by microorganisms. These microbes can enter the general circulation causing a bacteraemia. The result can be adverse systemic effects, which could promote conditions such as cardiovascular disease. Level A evidence supports that PD is independently associated with arterial disease. PD is a common chronic condition affecting the majority of Americans 30 years of age and older. Atherosclerosis remains the largest cause of death and disability. Studies indicate that the adverse cardiovascular effects from PD are due to a few putative or high-risk bacteria: *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola* or *Fusobacterium nucleatum*. There are three accepted essential elements in the pathogenesis of atherosclerosis: lipoprotein serum concentration, endothelial permeability and binding of lipoproteins in the arterial intima. There is scientific evidence that PD caused by the high-risk pathogens can influence the pathogenesis triad in an

The most common were *Pg* and *Aa*. Sixty-four pe… cent of those atheromas had two or more patho… gens. Only one of the atheroma from a patien… without PD demonstrated any oral pathogens.[3] I… 2011, 42 carotid endarterectomy specimens wer… analysed for oral pathogen DNA. Every atherom… had at least one pathogen, and many had multipl… pathogens. Again, the most common bacteria wer… *Pg* and *Aa*.[4] Oral pathogens create bacteraemia, an… those bacteria, especially the high-risk microbes, ar… frequently associated with atherosclerotic lesions.

The American Heart Association (AHA) state… after an extensive review of the literature that P… was independently associated with arterioscleroti… vascular disease (ASVD). This relationship wa… demonstrated with level A evidence. They discusse… in their statement several plausible mechanisms b… which PD could be associated with arterial disease… One explanation involves systemic inflammation… which can occur with periodontitis. This has bee…

Main messages

- Periodontal disease (PD) due to high-risk pathogens can adversely influence the atherosclerosis pathogenesis triad.
- PD caused by high-risk pathogens may be considered a contributory cause of arterial disease.
- The dental community has a substantial opportunity to mitigate the number one cause of morbidity and mortality, namely cardiovascular disease, by elucidating feasible effective management of PD due to high-risk pathogens.

https://baledoneen.com/blog/landmark-bale-doneen-discovery-oral-bacteria-can-cause-heart-disease/

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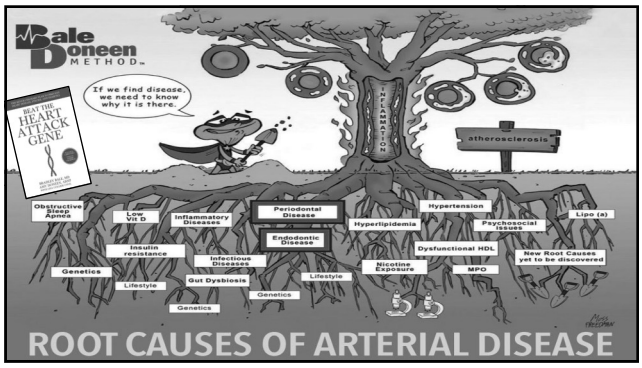

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Periodontal Disease and Cardiovascular Disease

Pg and high risk perio pathogens proven to CAUSE atherosclerosis	**People with oral inflammation 50% increased risk for Heart attack**	**People with oral inflammation 50% increased risk for stroke**
Pg increases risk twice as much as smoking	Non-surgical periodontal therapy shown to decrease risk of CVD	

High-risk periodontal pathogens contribute to the pathogenesis of atherosclerosis. Bale BF, Doneen AL, Vigerust DJ. Virulence. 2012 Jan 1;3(1):69-79. doi: 10.4161/viru.3.1.18664. Epub 2012 Jan 1. PMID: 22268963; PMCID: PMC3337169.

14

Staggering statistics

People with periodontal disease are
twice as likely to DIE from heart disease
and **three times as likely to DIE from stroke**
as those with healthy gums

Dhadse P, Gattani D, Mishra R. The link between periodontal disease and cardiovascular disease: How far we have come in last two decades ? *J Indian Soc Periodontol*. 2010;14(3):148–154. doi:10.4103/0972-124X.75908

15

Periodontal Treatment Saves Lives

"Improvement in periodontal status associated with diminished disease progression" INVEST Study 2013

Non-surgical periodontal therapy comparable to 30% drop in LDL cholesterol

Desvarieux M, Demmer RT, Rundek T, et al. Periodontal microbiota and carotid intima-media thickness: the Oral Infections and Vascular Disease Epidemiology Study (INVEST). *Circulation*. 2005;111(5):576–582. doi:10.1161/01.CIR.0000154582.37101.1S

16

Periodontal Disease and Diabetes

People with diabetes are immunocompromised and are more susceptible to periodontal disease

93% of people with diabetes have periodontal disease

Uncontrolled diabetes elevates blood glucose

Periodontal destruction occurs earlier and progresses faster

Porphyromonas gingivalis
Treponema denticola
Tannerella forsythia

People with diabetes also at risk for Caries, Salivary dysfunction and Candidiasis

Bascones-Martinez A, Matesanz-Perez P, Escribano-Bermejo M, González-Moles MA, Bascones-Ilundain J, Meurman JH. Periodontal disease and diabetes: Review of the literature. Med Oral Patol Oral Cir Bucal. 2011 Sep 1;16(6):e722-9. http://www.medicinaoral.com/medoralfree01/v16i6/medoralv16i6p722.pdf

17

Periodontal Disease and Alzheimer's Disease

Risk of Alzheimer's disease increases with elevated oral and systemic inflammation

Periodontal disease linked to 6x increase in rate of cognitive decline in people with Alzheimer's disease

Rates of PD higher in people with AD; less likely to engage in good oral hygiene

Watts A, Crimmins EM, Gatz M. Inflammation as a potential mediator for the association between periodontal disease and Alzheimer's disease. *Neuropsychiatr Dis Treat*. 2008;4(5):865–876. doi:10.2147/ndt.s3610

18

Periodontal Disease and Alzheimer's Disease

When cerebrospinal fluid of people with Alzheimer's disease was studied, Pg was found in 96% of the samples

More than 60 species of oral bacteria are found in the blood, spinal fluid, and brains of Alzheimer's patients, **including Pg and Td**

Neurospirochetosis

Porphyromonas gingivalis in Alzheimer's disease brains: Evidence for disease causation and treatment with small-molecule inhibitors. **Dominy S. et al.** ***Science Advances*** **23 Jan 2019: Vol. 5, no. 1, eaau3333 DOI: 10.1126/sciadv.aau3333**

19

Periodontal Disease and Pre-term, Low Birth Weight Babies

540,000+ *premature* births (<37 weeks) per year in US

50% of cases had "no known cause"

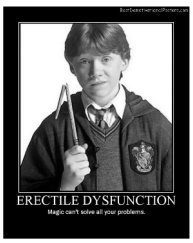
Gingivitis increases risk of pregnancy complications 2-7x

Pregnant women w/PD only 1 in 7 chance of healthy baby of normal weight

Wu M, Chen SW, Jiang SY. Relationship between gingival inflammation and pregnancy. *Mediators Inflamm*. 2015;2015:623627. doi:10.1155/2015/623627
Han YW, Fardini Y, Chen C, et al. Term stillbirth caused by oral Fusobacterium nucleatum. Obstet Gynecol. 2010;115(2 Pt 2):442–445. doi:10.1097/AOG.0b013e3181cb9955

20

Periodontal Disease and Male Reproductive Dysfunction



Elevated risk of low sperm count and concentration

Men with PD 3x more risk of erectile dysfunction

Men dx with ED 80% more likely to have PD than men without ED

Improved oral health can improve erectile function

Singh VP, Nettemu SK, Nettem S, Hosadurga R, Nayak SU. Oral Health and Erectile Dysfunction.
J Hum Reprod Sci. 2017;10(3):162-166. doi:10.4103/jhrs.JHRS_87_17
Tsao, CW., et al. "Exploration of the association between chronic periodontal disease and erectile dysfunction from a population-based view point." Andrologia. 2015 Jun;47(5):513-8. doi: 10.1111/and.12294. Epub 2014 May 18.
Ogus, Faith, et al. "Is There a Relationship Between Chronic Periodontitis and Erectile Dysfunction?" The Journal of Sexual Medicine. 2012.

21

Periodontal Disease and Cancer

- Pg found in 61% of esophageal cancer
- Pg increases risk of pancreatic cancer two-fold
- Fn linked to colorectal cancer
- Oral cancer risk increased with 1.5mm attachment loss
- Each mm of bone loss coincided with >5x increase in cancer risk
- Pg and Fn both implicated in OSCC

Meyer MS, Joshipura K, Giovannucci E, Michaud DS. A review of the relationship between tooth loss, periodontal disease, and cancer. *Cancer Causes Control.* 2008;19(9):895–907. doi:10.1007/s10552-008-9163-4

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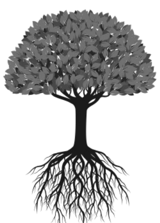
Root Causes Dental Diseases

- Pathogenic Microbes
- Saliva
- pH
- Diet
- Genetics
- Smoking
- Alcohol
- Stress
- Parafunctional Habits
- Systemic Diseases



Multi-factorial

https://baledoneen.com/blog/landmark-bale-doneen-discovery-oral-bacteria-can-cause-heart-disease/

Kaur G, Grover V, Bhaskar N, Kaur RK, Jain A. Periodontal Infectogenomics. Inflamm Regen. 2018;38:8. Published 2018 May 7. doi:10.1186/s41232-018-0065-x

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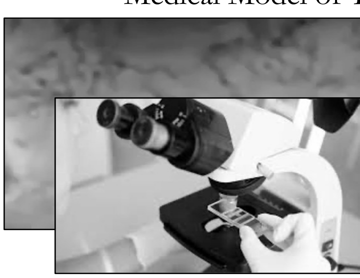
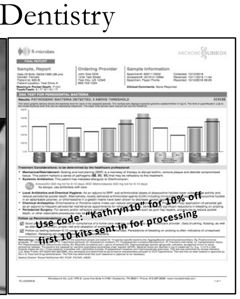
Medical Model of Dentistry

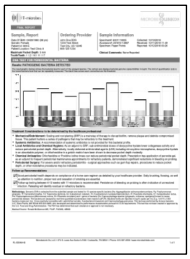




Integrated Medical-Dental Delivery Systems: Models in a Changing Environment and Their Implications for Dental Education Judith A. Jones, John J. Snyder, David S. Gesko and Michael J. Helgeson. Journal of Dental Education September 2017, 81 (9) eS21-eS29; DOI: https://doi.org/10.21815/JDE.017.029

24

Medical Model of Care: Bacterial DNA Testing



Integrated Medical-Dental Delivery Systems: Models in a Changing Environment and Their Implications for Dental Education Judith A. Jones, John J. Snyder, David S. Gesko and Michael J. Helgeson. Journal of Dental Education September 2017, 81 (9) e521-e529; DOI: https://doi.org/10.21815/JDE.017.029

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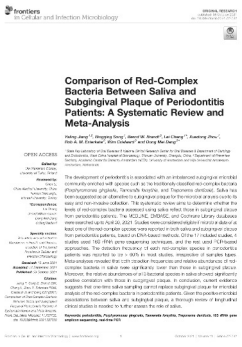

Comparison of Red-Complex Bacteria Between Saliva and Subgingival Plaque of Periodontitis Patients: A Systematic Review and Meta-Analysis

"...this systematic review shows that **the levels of red-complex bacteria in saliva were significantly lower than those in subgingival plaque** in patients with periodontitis, in terms of the detection frequency and relative abundance. "

Jiang, Yaling & Song, Bingqing & Brandt, Bernd & Cheng, Lei & Zhou, Xuedong & Exterkate, Rob & Crielaard, Wim & Deng, Dong. (2021). Comparison of Red-Complex Bacteria Between Saliva and Subgingival Plaque of Periodontitis Patients: A Systematic Review and Meta-Analysis. Frontiers in Cellular and Infection Microbiology. 11. 727732. 10.3389/fcimb.2021.727732.

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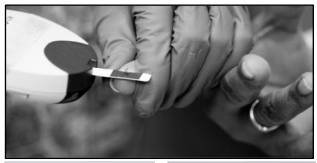
Laboratory Testing
HbA1c Blood Glucose Monitoring



Normal 5.4	Borderline Prediabetes 5.5-5.6	Prediabetes 5.7-6.4	Diabetes 6.5+

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Medical Model of Care
Inflammatory Blood Markers

CBC Complete Blood Count	Fasting Glucose/ GGT	Vitamin D 25-hydroxy	Vitamin B12 Folate B6	**CAC- Coronary Artery Calcium**
TSH Thyroid Stimulating Hormone	Cholesterol/ triglycerides	BMI	Urinalysis	Ferritin/ iron
Hs-CRP (chronic inflammation)	Fibrinogen	**Lp_PLA-2**	**MPO – myeloperoxidase (chronic inflammation)**	MACR – microalbumin ratio

Kalburgi V, Sravya L, Warad S, Vijayalaxmi K, Sajjal P, Hazeli DJ. Role of systemic markers in periodontal diseases: a possible inflammatory burden and risk factor for cardiovascular diseases?. *Ann Med Health Sci Res.* 2014;4(3):388-392. doi:10.4103/2141-9248.133465

28

Periodontal Treatment
Improves Systemic Health

Bale Doneen Vigarust

Non-surgical periodontal therapy comparable to 30% drop in LDL cholesterol

Non-surgical periodontal therapy significant beneficial effect on CIMT

Reduction in arterial plaque

Primary preventive health measure for CVD

Desvarieux M, Demmer RT, Rundek T, et al. Periodontal microbiota and carotid intima-media thickness: the Oral Infections and Vascular Disease Epidemiology Study (INVEST). Circulation. 2005;111(5):576–582. doi:10.1161/01.CIR.0000154582.37101.15
Bale, B, Doneen, A, Vigarust, D. High-Risk Periodontal Pathogens Contribute to the Pathogenesis of Atherosclerosis Postgraduate(2016

29

Goals of Non-surgical Periodontal Treatment

Complete debridement site by site
Followed by disease remission

To alter or eliminate microbial etiology and contributing factors

To halt the progression of disease

To restore a balanced oral microbiome

Drisko CH. Nonsurgical periodontal therapy. Periodontol 2000. 2001;25 77-88. doi:10.1034/j.1600-0757.2001.22250106.x. PMID: 11155183.
American Academy of Periodontology. Parameters of Care. J Periodontol 2000;71: 847-880

30

Acute Wound vs. Chronic Wound

Acute wound: injury followed by immune system response that results in complete resolution and healing.

Chronic wound: fails to heal in reasonable time (3 months); has **polymicrobial etiology** and prolonged host degeneration with generalized loss of tissue function due to increased inflammatory mediators and biofilm characteristics, such as decreased oxygenation.

Whitney JD. Overview: acute and chronic wounds. Nurs Clin North Am. 2005 Jun;40(2):191-205, v. doi: 10.1016/j.cnur.2004.09.002. PMID: 15924889.
Chronic Wound Management of Periodontal Disease. Keller, Duane Clay. Oral Biology and Dentistry. Volume 6. Article 2. ISSN 2053-557.

31

Wound care protocols in medicine

Repeated debridement of biofilm and dead tissue

Repeated application of topical antibiotic gel following debridement

Hyperbaric oxygen therapy increases concentration; stimulates blood vessel growth

Xylitol with anti-adhesion properties to prevent biofilm from adhering to tissues

Lactoferrin, **xylitol, arginine** or other products to prevent bacteria from clumping together

Long-term therapy – 3-12 months

R. Wolcott, MD. Disrupting the biofilm matrix improves wound healing outcomes. Journal of Wound Care, 24(8) August 2015
Regular debridement is the main tool for maintaining a healthy wound bed . Wolcott, RD et al, https://www.advancedresidency.org/offline_4wh.pdf

32

Wound care protocols in periodontal therapy

Repeated debridement of biofilm and dead tissue

Repeated application of topical antibiotic or antimicrobial gel or rinses following debridement

Xylitol with anti-adhesion properties to prevent biofilm from adhering to tissues

Xylitol, arginine or other products to prevent bacteria from clumping together

Long-term therapy – 2-6 weeks active therapy and 6-12 weeks supportive maintenance

Chronic Wound Management of Periodontal Disease. Keller, Duane Clay. Oral Biology and Dentistry. Volume 6. Article 2. ISSN 2053-557.

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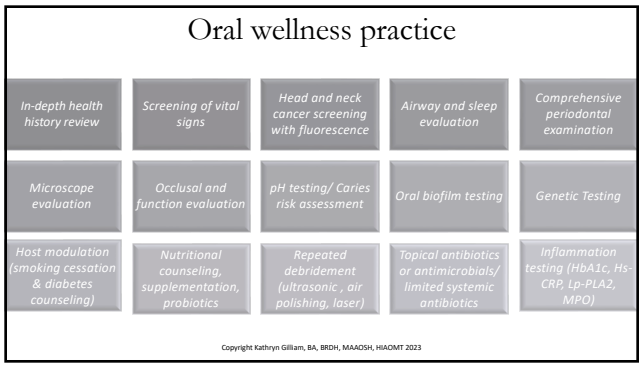
Oral wellness practice
In-depth health history review
Screening of vital signs
Head and neck cancer screening with fluorescence
Airway and sleep evaluation
Comprehensive periodontal examination
Microscope evaluation
Occlusal and function evaluation
pH testing/ Caries risk assessment
Oral biofilm testing
Genetic Testing
Host modulation (smoking cessation & diabetes counseling)
Nutritional counseling, supplementation, probiotics
Repeated debridement (ultrasonic , air polishing, laser)
Topical antibiotics or antimicrobials/ limited systemic antibiotics
Inflammation testing (HbA1c, Hs-CRP, Lp-PLA2, MPO)
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