

New Horizons in Periodontal Therapy

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Presenter Disclosures for Betsy Reynolds, RDH, MS

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Agenda

- Landmarks in Periodontal Therapy
- Relationship Between Oral and Systemic Conditions
- Microbial and Immunological Challenges
- Periodontal Therapy Considerations
- Wrap-Up

1980's: Role of Immune Status

'Immunocompromised' refers to a individual with either a hypo- or hyperfunctioning immune system

Key Points:

- Most autoimmune disorders are AB-mediated
- Multifactorial
- Increase incidence with age
- Genetic predisposition is common (much more likely to affect females)

Autoimmunity disproportionately affects women—ratios vary by disease but, overall, almost 80% of people with autoimmune disorders are female

Autoimmune disorders can affect virtually ANY site in the body—including the oral cavity

Examples of Autoimmune Disorders

- Rheumatoid arthritis
- Scleroderma
- Systemic lupus erythematosus
- Psoriasis
- Crohn's disease

Rheumatoid Arthritis

Rheumatoid arthritis is mainly characterized by inflammation of the joints and can lead to long-term joint damage, resulting in chronic pain, loss of function and disability

Affecting 1.5 million Americans, RA most often affects people in middle age (although it can begin at any stage of life) and often starts with only minor joint pain and stiffness in the beginning

Clinical Considerations

- In a 2001 Australian study, people who had rheumatoid arthritis were more than TWICE as likely to have periodontal disease with moderate to severe bone loss as the control subjects— additionally, RA sufferers averaged 11.6 missing teeth compared to 6.7 in the control group

- In a more recent study, German researchers found that RA status and age were significant predictors of periodontal disease—they discovered that patients with RA were EIGHT times more likely to have periodontal disease compared to control patients

At this point, researchers are not saying the relationship between the two diseases is causal—however, some scientists think a bacterial infection may trigger the disease process in some of the people with rheumatoid arthritis

Headliners: Metagenomic Study Finds Differences in Oral, Gut Microbiomes of Rheumatoid Arthritis Patients; Jun Wang et al; BGI; Results appearing in Nature Medicine; 7/27/15; accessed on 8/4/15 at: <https://www.genomeweb.com/sequencing-technology/metagenomic-study-finds-differences-oral-gut-microbiomes-rheumatoid-arthritis>

The oral and gut microbiomes of people with rheumatoid arthritis apparently differ from those of healthy people

Jun Wang and his colleagues of BGI (the largest genomic research facility in the world) found that, while the etiology of rheumatoid arthritis remains elusive, the research team believe that both genetic and environmental (including microbial) factors appear to influence disease development

The investigators analyzed fecal, dental, and salivary samples from people with RA and controls—the oral and gut microbiomes of people with RA differed from controls in both the composition and functions of the microbes present

‘Our [study] supports the notion that RA represents a state of chronic inflammation that might be provoked or aggravated by the overgrowth of pathogenic bacteria or a lack of immune-modulating commensal bacteria. These findings are a first step toward microbiome-based therapeutics and patient stratification in preclinical and clinical phases of RA.’--Wang

Lactobacillus salivarius was found in all three tested sites in RA patients—interestingly, this microbe has gained attention in recent years as a promising probiotic species (defined as ‘...living micro-organisms which upon ingestion in certain numbers exert health benefits beyond inherent nutrition’)

CAUTION!

- Research findings vary greatly when it comes to Lactobacillus salivarius
- While some studies have reported oral administration of L. salivarius improved bad breath, showed beneficial effects on bleeding on probing from the periodontal pocket, and inhibited the reproduction of pathogenic bacteria, other investigations have shown conflicting findings as to the benefits of this probiotic in caries or periodontal inflammation prevention

Headliners: Rheumatoid Arthritis Patients Are Using Medical Marijuana; Reported by David Downs; 7/8/15; accessed on 8//15 at: <http://blog.sfgate.com/smellthetruth/2015/07/08/rheumatoid-arthritis-patients-are-using-medical-marijuana-heres-why/>

More and more aging baby boomers are dealing with the long-term ramifications of chronic RA—and are increasingly turning to medical marijuana to treat the multiple forms of pain (including neuropathic pain) associated with RA cartilage degradation

Arthritis pain is reported as one of the most common reasons for persons using medical herbal cannabis in North America—severe arthritis is the condition justifying legal use of cannabis in over half of all authorizations in Canada

Cannabinoid receptors are present throughout the body and are embedded in cell membranes—they are believed to be more numerous than any other receptor system in the body

Knowledge of these receptors—CB1 and CB2—has greatly enhanced the overall knowledge of how cannabinoids synergistically interact with other cannabinoids and endocannabinoids to produce sometimes profound systemic effects

2-arachidonoylglycerol (2-AG)

As the most abundant endocannabinoid, 2-AG is a full agonist for cannabinoid receptors (CB1 and CB2)—although, as a potent immune modulator, 2-AG is often recognized as the primary agonist for the CB2 receptor

CB2 receptors occur mainly in peripheral locations of the cells and organs associated with the immune system and are involved in control of inflammatory reactions—upon stimulation by 2-AG, inhibition of the release of proinflammatory cytokines and increased release of anti-inflammatory cytokines is seen
Source: Zubrzycki M et al: A New Face of Endocannabinoids in Pharmacotherapy; accepted for publication 16 DEC 2013; accessed on 26 OCT 2017 at:

http://www.jpp.krakow.pl/journal/archive/04_14/articles/02_article.html

2-AG was shown to inhibit the overexpression of inflammatory cytokines such as tumor necrosis factor alpha (TNF- α), IL-1 β , and inducible nitric oxide synthase (iNOS)--Source: Ben Li et al: Endocannabinoid 2-arachidonoylglycerol protects inflammatory insults from sulfur dioxide inhalation via cannabinoid receptors in the brain; appearing in Journal of Environmental Sciences; Volume 51, January 2017, Pages 265–274. Accessed on 26 OCT 2017 at:

<http://www.sciencedirect.com/science/article/pii/S1001074216302340>

Complex tasks coordinated by the body and brain (such as appetite, sleep, and pain perception) are also influenced by 2-AG because of its effects on the CB1 receptors

Summary of 2-AG Functions:

- Immune function***
- Bone health***
- Pain***
- Mood
- Metabolism
- Reproduction
- Memory
- Movement
- Sleep
- Neuroprotection

Scleroderma

Scleroderma is a chronic, degenerative, autoimmune disorder that leads to the over-production of collagen in the body's connective tissue—the word 'scleroderma' means 'hardening of the skin' and refers to one of the possible physical effects of the disease

The National Institute of Arthritis and Musculoskeletal and Skin Disease, recognizes that although scleroderma is often referred to as if it were a single disease, in fact, it is really a symptom of a group of diseases that involve the irregular growth of collagen

Oral manifestations of Scleroderma include:

- Microstomia***
- Xerostomia
- Raynaud's phenomenon***
- Periodontal diseases (uniform widening of the PDL)***
- Mucosal and skin disease
- Osseous resorption***

Mandibular resorption in systemic sclerosis is relatively uncommon and is reported only in 10% of cases

Headliners: Drugs That Reverse Fibrosis in Scleroderma Step Closer; Richard Neubig; lead investigator; professor and chairperson; Department of Pharmacology and Toxicology; Michigan State University; results published in the Journal of Pharmacology and Experimental Therapeutics; 4/14; accessed online 8/4/15 at: <http://www.medicalnewstoday.com/articles/275144.php>

Researchers say they have discovered a promising target for new drugs that might be able to reverse the fibrosis process in scleroderma—a core genetic pathway that that throws the main switch for all the signaling pathways in scleroderma

By validating this core switch ('MRTF/SRF gene transcription pathway') as a viable drug target, the researchers are hoping to improve treatment strategies and drug dosing—significantly changing the quality of life for scleroderma patients and greatly lengthening the lives of systemic patients

Lupus Erythematosus ('LE')

In lupus, the regulation of immune system goes awry and the body produces autoantibodies that attack host cells resulting in inflammation that causes redness, pain and swelling in the affected parts of the body

Also referred to as 'systemic lupus erythematosus', this autoimmune disorder attacks healthy organs and tissues, including the joints, skin, blood cells, lungs, heart, kidneys and brain

Ninety percent of people with lupus are female, and the disease typically starts between the ages of 15 and 40

Lupus is two to three times more common among African Americans, Hispanics, Asians, and Native Americans than among Caucasians

Although the cause for lupus is unknown, it likely requires an environmental stimulus in presence of many susceptibility genes

Headliners: Differing Chemical Tags on DNA Hint Why Lupus Is Not Identical in Twins; As reported by Tina Hesman Saey; appearing in Science News; 1/16/10

Lupus apparently can tell identical twins apart by the distinguishing marks the pairs carry on their DNA—the finding suggests that environmental factors determine whether genetically susceptible twins will contract systemic lupus erythematosus

Researchers have previously identified at least 17 different genes involved in lupus—if genes alone were responsible for determining whether a person gets lupus, then every time one identical twin got the disease, the other would, too

But that does not happen:

- Between 40% and 75% of the time, when one twin develops the disease, the other stays healthy—leading investigators to assume that some environmental factor must trigger the disease--Bruce Richardson; rheumatologist; University of Michigan Medical School (Ann Arbor)

Key Points:

- Lupus produces widely varying symptoms
- Lupus can cause short periods of symptoms alternating with healthy periods—or it can progress into a life-threatening disorder affecting the heart, kidneys, and other organ systems

Symptoms MAY include:

- Fatigue
- Joint pain
- Shortness of breath
- Butterfly Rash
- Visual impairment
- Photosensitivity

- Skin lesions
- Cardiac conditions
- Seizures
- Oral ulcerative lesions

Almost all people with LE have joint pain and most develop arthritis—frequently affecting joints of the fingers, hands, wrists, and knees

The ‘hallmark lesion’ of lupus is a malar—or ‘butterfly’—rash which presents as an erythematous rash across the bridge of the nose

Inflammation of various parts of the heart may occur as pericarditis, endocarditis, or myocarditis—chest pain and arrhythmias may result

Oral lesions occur in 10%-40% of patients

Lesions typically appear on the buccal mucosa and exhibit lichenoid characteristics

Headliners: Lupus: Spike Seen in Hospital Admissions for Infections; Michael M. Ward, MD; lead investigator; National Institute of Arthritis and Musculoskeletal and Skin Diseases; Bethesda, MD; results appearing in Arthritis Care & Research.; 8/14; As reported by Nancy Walsh; Senior Staff Writer; MedPage Today; accessed on 8/4/15 at:

<http://www.medpagetoday.com/Rheumatology/Lupus/52814>

In a national study, investigators found rates of hospitalization for serious infections among patients with systemic lupus erythematosus are substantially higher than in the general population—and have been rising in recent years

For instance, the relative risk among SLE patients of hospitalization for opportunistic infections compared with non-SLE patients rose from 8.8 in 1996 to 24.1 in 2011

Serious infections have been estimated to account for up to 37% of all hospitalizations among patients with SLE—as well as two-thirds of avoidable hospitalizations and one-third of deaths

‘We found strikingly high relative risks of hospitalizations for serious infections, which underscores the high burden of infections in SLE. [Infections remain a major concern in SLE and] adoption of guidelines for the prevention and management of infections, as have been successfully used in other diseases, are urgently needed.’ --study authors

Psoriasis

Psoriasis is the most common autoimmune disease in the United States—affecting more than 7.5 million people

Psoriasis is not a contagious skin disorder and occurs when the immune system sends out faulty signals that speed up the growth cycle of skin cells

Different types of psoriasis display characteristics such as pus-like blisters (pustular psoriasis), severe sloughing of the skin (erythrodermic psoriasis), drop-like dots (guttate psoriasis) and smooth inflamed lesions (inverse psoriasis)

The most common form—plaque psoriasis—appears as raised, red patches or lesions covered with a silvery white buildup of dead skin cells (called scale)

Psoriasis can occur on any part of the body and is associated with other serious health conditions, such as diabetes, heart disease and depression

Oral Psoriasis

Although rare, oral psoriasis occurs and can have a variety of manifestations

Why so rare?

- Epithelial turnover time is significantly increased in psoriatic plaques and may be as rapid as 3 to 7 days—normal epithelial turnover is 28 days

- Some have suggested that this abnormally increased turnover time in psoriasis approximates that of the normal regenerative time of the oral epithelium, and this possibility may account for the apparent lack of changes in the oral mucosa of patients with psoriasis

Patients exhibiting oral psoriatic lesions will most often have severe forms of psoriasis such as generalized pustular psoriasis

Clinical Tip:

- The diagnosis of oral psoriasis should be based on good clinical and histologic evidence, and, in general, the clinical course of the oral lesions should parallel that of the skin disease

Patient Recommendations:

- Eat the right foods (elimination of sugar or sugar syrups, grain that is not 100% whole, and most saturated fats and ALL trans fats can be beneficial)
- Ingest omega-3, purified omega 7 or a couple of teaspoons of olive oil daily will reduce inflammation
- Get at least 7-8 hours of sleep nightly
- Cortisone cream may be prescribed
- A daily vitamin D3 supplement may help
- Use of a home humidifier (make sure it stays clean!)

Headliners: Cyndi Lauper’s Psoriasis: Pop Star Is ‘PsO’ Ready To Open Up About Her Skin Disease; Reported by Emma Hernandez; 8/3/15; accessed on 8/4/15 at: <http://scribol.com/anthropology-and-history/the-insane-body-piercings-of-phukets-vegetarian-festival/14?image=14>

Pop icon Cyndi Lauper has teamed up with the National Psoriasis Foundation and Novartis Pharmaceuticals on the ‘I’m PsO Ready’ campaign to spread awareness of psoriasis

“I am usually a very vocal and open person, but I think sharing your psoriasis story is very personal and takes a lot of courage. Raising awareness and educating others is critical. It is very easy to feel isolated. Through ‘I’m PsO Ready,’ I want people living with the condition to understand that we don’t have to be embarrassed, we don’t have to cover up and we don’t have to settle for life the way it is.”

The ‘I’m PsO Ready’ information campaign is part of the ‘More To Psoriasis’ initiative, intended to spread awareness about the disease and allow people to communicate their struggles so that they can educate others about what life is like living with psoriasis—it also aims to encourage people suffering with the disease to seek treatment

www.moretopsoriasis.com

Bottom Line:

Like other autoimmune diseases, psoriasis cannot be cured—symptoms can be managed to a certain extent and exacerbations can be minimized to a degree

Crohn’s Disease

Crohn’s disease involves inflammation in the gastrointestinal tract and may affect the large or small intestine, rectum and/or mouth

Crohn’s Disease by the Numbers (Source: Accessed on 8/4/15 at: <http://www.healthline.com/health/crohns-disease/things-doctors-want-you-to-know-about-crohns>)

1. There Are Flare and Remission Phases

Most people with Crohn’s disease cycle through flare-ups and remissions—during remission phase, Crohn’s sufferers feel pretty normal

Common symptoms of a Crohn’s flare-up include:

- Abdominal pain (which typically worsens after meals)
- Diarrhea
- Painful bowel movements

- Blood in stool
- Weight loss
- Anemia
- Fatigue

2. More People Are Diagnosed Each Year

Roughly 700,000 Americans have been diagnosed with Crohn's disease—and that number continues to rise--Source: the Crohn's & Colitis Foundation of America (CCFA)

KEY: Men and women are equally affected!

Symptoms of the disease can start at any age, although, it most often shows up in adolescents and young adults between the ages of 15 and 35

3. No One Knows Exactly What Causes Crohn's

Most researchers believe CD results from an interaction of three factors:

Genetic or hereditary factors

Environmental triggers (such as medications, pollution, excessive antibiotic use, diet, and **infections*****)

A wayward immune system that starts attacking its own GI tissue

Many believe that a virus or bacteria may be involved in the development of Crohn's disease causing the initial damage to the lining of the GI tract—however, it is not yet known which organism might be involved

4. Smoking Can Make Symptoms Worse

Research is suggesting that there may be a connection between cigarette use and Crohn's disease—not only can smoking cause people to have worse or more frequent symptoms but some data suggests that cigarette smoking may even increase the chance of developing Crohn's disease

'Smoking has been reported to affect the overall severity of the disease, with smokers having a 34% higher recurrence rate than nonsmokers.'--Akram Alashari, M.D.; surgeon and critical care physician; University of Florida

5. Crohn's Disease May Increase the Risk of GI Cancer

The risk of colorectal cancer is about three times higher in people with Crohn's disease

6. Non-judgmental Support is Important

Emotional support is vitally important to those battling Crohn's—listen to their feelings and be supportive

The main symptoms of Crohn's include abdominal pain, pain when passing stools, persistent diarrhea, fatigue, fever and weight loss—additional symptoms include joint pain and swelling, eye inflammation, mouth ulcers, constipation, rectal bleeding and other problems

The oral mucosa is commonly affected in Crohn's disease with up to one third of patients reported to have oral changes (the rate of oral lesions is higher in children)

KEY: Oral changes precede the diagnosis of Crohn's disease in the majority of cases

Nodular or diffuse soft swelling, a cobblestone appearance of the mucosa, mucosal tag lesions, ulcers, angular cheilitis, and aphthous-like ulcerations are often seen in cases of Crohn's disease

Lip swelling is one of the most common oral manifestations of the disease

Granulomatous cheilitis has been recognized as an early manifestation of Crohn's disease—it may follow, coincide with or precede the onset of Crohn's disease

KEY: Significant swelling of the lower lip due to granulomatous cheilitis could be the first manifestation of Crohn's disease, preceding intestinal symptoms!

Exacerbation of the lip lesion can be associated with a relapse of the underlying intestinal disease

Orofacial Signs of Malabsorption

- Folic acid deficiency (glossy, painful tongue and cheilitis)
- Iron deficiency

- Zinc deficiency (oral candidiasis, glossitis)
- Vitamin A deficiency (heightened keratinization of mucous membranes)
- Vitamin B complex deficiency (stomatitis, glossitis, angular cheilitis)
- Vitamin C deficiency (scurvy)
- Vitamin K deficiency (gingival bleeding)

Headliners: Triggering Autoimmune Assaults: Mouth Bacteria Unleash Inflammation-Inducing Protein Raloff J; as reported in ScienceNews; 5/10/08

Researchers from the University of Connecticut Health Center are reporting that certain oral microbes—notably *Porphyromonas gingivalis*—can inappropriately rev up the immune system which may ultimately lead to autoimmunity

One ‘trigger contender’ is a fatty compound— phosphoethanolamine dihydroceramide (‘PEDHC’) —a product of the common periopathogen

Once in the bloodstream, PEDHC encounters immune cells which misinterpret the product as actual bacteria and mount a full-blown attack

The findings of this study are potentially VERY important: ‘It presents a new area to look at in terms of possible therapeutic agents’ to prevent autoimmune diseases or diminish their severity--Nicholoas LaRocca; National Multiple Sclerosis Society (which funded the study)

Also weighing in:

‘There is evidence to suggest that periodontitis could indeed be a causal factor in the initiation and maintenance of the autoimmune inflammatory response that occurs in [rheumatoid arthritis]. If proven, chronic periodontitis might represent an important modifiable risk factor for RA.’--Nature Reviews Rheumatology 5, 218-224 (April 2009): Paola de Pablo et al: Periodontitis in systemic rheumatic diseases Any thoughts on what may limit infections????

Unfortunately, *Porphyromonas gingivalis* is not the only autoimmunity trigger contender

Headliners: Women Smokers at Greater Risk for Rheumatoid Arthritis; Iowa Women’s health Study; research findings published in Annals of the Rheumatic Diseases; 8/06

Smoking nearly DOUBLES the odds of rheumatoid arthritis in women who do not have genetic risk factors (‘HLA-DRB1 SE’) for the disease

1990’s: Shift towards educating the patient to be co-clinician

Risk factors for periodontal diseases were recognized

They included:

- Diabetes mellitus
- Pregnancy
- HIV infection
- Smoking and substance abuse

Effects of medications on periodontal health were identified

Gingival overgrowth as a result of:

- Anticonvulsants (phenytoin)
- Calcium channel blockers (nifedipine)
- Immunosuppressants (cyclosporine)

Other effects of systemic medications:

- Alteration of inflammatory response (corticosteroids)
- Increase bleeding tendencies (anticoagulants)
- **Xerostomia*****

Whole saliva contains at least **EIGHT different antimicrobial factors** that are substantially diminished with xerostomia

They include:

- Lysozyme
- Lactoferrin
- Salivary peroxidases
- Myeloperoxidase
- Proline-rich proteins
- Agglutinins and aggregating agents
- **Histatins**
- **Lactoferrin**

Lactoferrin is a substance belonging to a family of chemicals called cytokines that are responsible for coordinating immune responses involved in preventing disease and infection

Lactoferrin has the unique ability to bind to iron—an essential mineral used not only by host cells but also a wide array of pathogens and tumors depend on iron for reproduction and growth

Presented with an infectious challenge or tumor, a healthy body will respond by producing lactoferrin in copious quantities in the vicinity of the infection or tumor where it binds systemic iron and renders it unavailable to the bacteria or malignant cells

Lactoferrin does not remove iron from the body itself and, over time, degrades to release the iron back into the body

Another attribute of lactoferrin involves its antimicrobial ability—special sections of lactoferrin molecules are themselves directly toxic to bacteria, yeast and molds

Lipopolysaccharide (LPS), a pathogen produced by periodontal bacteria, not only stimulates the progress of periodontal disease but also increases the level of cholesterol and triglycerides in the blood

Researchers have discovered that lactoferrin is one of the most promising ingredients for neutralizing these actions of LPS

It also appears that lactoferrin inhibits replication of some viruses—including HIV and some of the herpes family of viruses

In addition, lactoferrin has demonstrated positive control of *Candida albicans* —especially when combined with fluconazole in treating resistant candidiasis in HIV+ patients

Histatin

Histatins are a family of salivary proteins with bactericidal and fungicidal activities that contribute to the innate defense of the oral cavity

Histatins are present in the serous granules of the parotid and submandibular glands

Histatins are important for the initial stage of wound healing in which fast wound coverage is important for healing without infection, inflammation, or fibrosis development

Histatin's presence in acquired pellicle prevents adhesion by *Streptococcus mutans*

Histatins play a MAJOR role in inhibition of candidiasis

Challenges for the 2000's

More people living longer than ever before also presents an increase in chronic and disabling diseases affecting the orofacial region

Over 20% of adults are affected by clinical symptoms of viral infections and canker sores

An estimated 55 million Americans suffer from 'canker sores'

Most are women of higher SES

More than 400,000 cancer patients will develop oral complications as a result of treatment
In recent years, a growing body of scientific evidence suggests an exquisite link between oral inflammation and the development of systemic disorders

Cardiovascular Disease

Inflammation in Review

- Lacking tools to describe interactions among cells and molecules, early doctors defining inflammation had to focus on what they could see and feel—today, we know that the outward signs of inflammation reflect a pitched struggle playing out on a microscopic battlefield
- Chronic wound states—such as periodontal inflammation—fail to progress through the normal pattern of wound repair and instead remain in a state of chronic inflammation predominantly characterized by abundant neutrophil and macrophage infiltration

Neutrophil

As ‘first line defenders’, PMN’s are effective at destroying many types of antigens

They are the ‘kamikaze cells’ of the defense system as they are often killed by toxins which they have eaten

The accompanying large-scale migration by these ‘first responders’ causes extravasation of a few red blood cells resulting in the hallmark erythema associated with acute inflammation

Neutrophils eat bacteria—these cells are ‘phagocytes’—and they also release powerful enzymes

When something is wrong with neutrophil function, periodontal diseases result

Macrophage

During an acute inflammatory response, macrophages stationed in the tissue are alerted that a buffet is waiting for them

Macrophages have ‘antennae’ (receptors) which recognize ‘danger molecules’ associated with microbial invaders

The stimulated surface receptors cause the macrophage to ‘crawl’ towards the microbial invader

When a macrophage encounters a bacterium, it engulfs the antigen in a pouch which is then taken inside the phagocyte where it is digested

‘Macro’ means ‘large’ and ‘phage’ is derived from the Greek word ‘to eat’—pretty good name because macrophages are indeed ‘big eaters’

Macrophages are not very etiquette prone and not only leave debris from their meals behind but actually ‘belch’ some of their food back into the tissue—which serves to signal MORE defenders from the blood

Additionally, during their battle with microbes, macrophages produce cytokines—hormone-like messengers which allow for cell-to-cell communication

Persisting inflammatory cells play a major role in the generation of proinflammatory cytokines and a protease rich and pro-oxidant hostile microenvironment

Having BOTH inflammation and high cholesterol together is especially dangerous—resulting in a NINE-FOLD increase in cardiovascular risk

A ‘healing’ process also accompanies the more chronic, low-level kind of inflammation that operates in atherosclerosis

By carefully examining vessel walls of people who have died from heart attacks, pathologists have demonstrated that most attacks occur after a plaque’s fibrous cap breaks open, prompting a blood clot to develop over the break

Headliners: High Blood Pressure Causing More Deaths Despite Drop in Heart Disease, Stroke Deaths; Mozaffarian D et al: Heart disease and stroke statistics--2015 update: a report from the American Heart Association; Circulation. 2015 Jan 27;131(4): 12/17/ 2014; results published by American Heart Association News; accessed on 8/14/2017 at: <http://news.heart.org/high-blood-pressure-causing-deaths-despite-drop-heart-disease-stroke-deaths/>

Although cardiovascular disease is still the biggest killer in the U.S., deaths fell by nearly a third from 2001 to 2011—a drop scientists say reflects improvements in preventing and treating heart disease and stroke

Concerns are growing, however, over a 13% increase in hypertension-related deaths over that same span

High blood pressure is a major risk factor for heart disease and stroke

KEY: Although the death rate was increasing for HBP while the death from cardiovascular accident was declining may seem contradictory, one reason is that hypertension can directly lead to other deadly conditions such as heart failure or kidney failure if it is not controlled

‘Awareness is not enough. We have to begin to adequately treat hypertension. We can’t get there by treating coronary artery disease alone.’--Willie E. Lawrence Jr., M.D.; chief of cardiology; Research Medical Center; Kansas City, MO; citing the AHA’s 2020 goal to reduce deaths from cardiovascular diseases and stroke by 20%

Headliners: Heart Drug Lacks Long-Term Benefit; Bangalore, Sripal; study co-author; interventional cardiologist; New York University School of Medicine; study results appearing in JAMA; 10/3/12; as reported in Science News; 11/17/12

Researchers recently reported that beta blockers fail to protect against strokes and heart attacks even while helping to control heart rate and blood pressure

The study team examined thousands of patients with a history of heart attack, coronary artery disease or coronary artery disease risk factors—when results for the nearly 22,000 participants were compared, those receiving beta blockers demonstrated little or no difference in rates of subsequent heart attacks, strokes or death from a cardiovascular cause

The American Heart Association previously discouraged the long-term use of beta blockers in those with heart risk factors or as a post-heart attack treatment beyond three years—this study further discourages the long-term use of these drugs following a cardiovascular event

Oral Inflammation and Pregnancy

During pregnancy, blood flow increases throughout the body by about 30%-50%

One result of increased blood flow to gingival tissue is that oral bacteria get plenty of nutrition—leading to more bacteria and swollen, edematous gingiva

The pattern of pregnancy gingivitis seems to follow the hormonal cycle and is more evident in the 2nd or 3rd trimester

Some interesting research has demonstrated distinct hormonal influences on the immune systems of pregnant women—which may contribute significantly to the etiology of pregnancy gingivitis

Among the ‘immune tidbits’:

- Lymphocytes have a decreased antigenic response (Prevotella intermedia)
- Migration of inflammatory cells and fibroblasts is hampered
- **Prostaglandin E2** increases in response to progesterone (**important in PTLBW link to oral inflammation*****)

During pregnancy, prostaglandin levels gradually increase—reaching their peak at the time of labor
A woman’s body reacts to the infections in her mouth by producing prostaglandins—very potent inflammatory mediators

If extra prostaglandins are being produced—such as those associated with gingivitis—a woman’s body may interpret this as a sign it is time to go into labor (even though the baby is not at full term) Defined as delivery before 37 complete weeks of pregnancy with a birth weight of less than 2500 grams (5.5 pounds), PLBW babies have a greater risk of morbidity, mortality and disability Although medical advances have greatly increased survival rates, preterm birth is still the most important cause of perinatal mortality and morbidity

Some Pre-Term Stats to Consider:

In the U.S., 1 in 10 babies is born prematurely—and the preterm birth rate is higher than that of most high-income countries--Source: March of Dimes 2015 Premature Report Card; accessed on 3/30/2016 at: <http://www.marchofdimes.org/mission/prematurity-reportcard.aspx>

In April 2010, it was first reported that 12.7% of births in the United States are pre-term deliveries—a rate that reflected a 36% increase over the last 25 years--Fardina Y et al; Case Western Reserve University and Hathaway Brown School

The link between PTLBW and periodontal inflammation

In 2004, the March of Dimes began the Prematurity Research Initiative (PRI), which funds research into the causes of prematurity—since then, nearly \$28 million has been awarded to 88 grantees

Some PRI grantees are exploring how genetics or a combination of genetic and environmental factors may influence a woman’s chances of going into labor prematurely—others are examining how infections may trigger early labor

Research has suggested that ~25% of pregnant women demonstrate increased periodontal pocketing during pregnancy and that this condition raises the risk of prematurity

Researchers are reporting that infections involving a woman’s uterus may contribute to about 1 of every 4 premature births and often cause no symptoms

Women with periodontal diseases are at THREE to FIVE times greater risk of preterm birth than those who are periodontally healthy

Babies of mothers with periodontal infections are TWICE as likely as other babies to be admitted to the neonatal intensive care unit and THREE times more likely to require extended hospital stays beyond seven days

Overall, the current studies of gingival inflammation during pregnancy show a risk level for prematurity comparable to that of heavy drinking (more than 10 drinks a week) and somewhat higher than most estimates for smoking--Deepi Brar; Dental Care During Pregnancy; accessed at:

<http://consumer.healthday.com/encyclopedia/article.asp?AID=643496> on 7/24/12

Maternal oral health is not the only reason for PLBW—the mother’s overall health, resources and prenatal care are crucial— however, bacteria associated with maternal periodontal inflammation and caries may play a significant role

The mouth is home to hundreds of different types of bacteria—some are good and some are implicated in dental disease

Although researchers are not sure of the exact mechanism(s), oral bacteria and molecules the body produces against them can enter the uterine environment through the bloodstream and influence the delivery process

‘When oral bacteria in the mother’s blood ...reaches the fetus, it triggers an immune and inflammatory response...[which] may account for up to 50% of premature births’

‘There is a compelling body of evidence from basic science and clinical studies to demonstrate that intrauterine infection is strongly associated with fetal inflammation. There is also excellent data to suggest that the intrauterine inflammation that is implicated in the precocious initiation of labor also plays a role in the development of a number of the congenital pathologies that are commonly identified in preterm infants, such as bronchopulmonary dysplasia and white matter injury. Accordingly, identifying the...origins of intrauterine inflammation, and how it might differ on an individual, case-by-

case basis, is likely an important requirement in our efforts to develop treatments that prevent PTB while ensuring the continued development of a healthy fetus.'--Source: Kemp MW. Preterm Birth, Intrauterine Infection, and Fetal Inflammation. *Frontiers in Immunology*. 2014;5:574; accessed 3/30/2016 at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4249583/>

Periodontal treatment during pregnancy is not only safe but may improve pregnancy outcomes It has been suggested that pregnant women should receive at least TWO thorough cleanings during their pregnancies to minimize inflammation and bacteria—preferably with an ultrasonic instrument

'Because periodontal disease is associated with local and systemic inflammation, treating periodontal disease during pregnancy may be too late to reduce the inflammatory burden that is associated with adverse pregnancy outcomes.'--Source: Kim A. Boggess, MD; Periodontal disease and preterm birth; 12/1/2012; *Contemporary OB-GYN*; accessed on 3/30/2016 at:

<http://contemporaryobgyn.modernmedicine.com/contemporary-obgyn/news/modernmedicine/modern-medicine-feature-articles/periodontal-disease-and-pret?page=full>

'Although some studies have shown a possible association between periodontal infection and preterm birth, evidence has failed to show any improvement in outcomes after dental treatment during pregnancy. Nonetheless, these studies did not raise any concern about the safety of dental services during pregnancy. To potentiate general health and well-being, women should routinely be counseled about the maintenance of good oral health habits throughout their lives as well as the safety and importance of oral health care during pregnancy.'--Source: American Congress of Obstetricians and Gynecologists; Committee on Health Care for Underserved Women; 8/2013 (reaffirmed 2015)

The Impact of STRESS on Health

Stress is the way we react physically, mentally, and emotionally to various conditions, changes, and demands in our lives

Our minds react with concern, worry, or fear

Our bodies react by secreting stress chemicals and hormones

The physiological stress circuit existed in primitive humans as a mechanism to ensure the survival of our species

Headliners: Brain is equipped to register fear and worry more sensitively than any other emotion

Nature does not consider happiness essential for survival

Only attached intense pleasure to procreation and eating because they are necessary for survival

When stressors are relatively acute but infrequent, our bodies have an opportunity to clear the stress hormones and return to more baseline or 'normal' conditions

When stressors are frequent and pervasive, the body do not have enough time to reverse the harmful physiological effects

Symptoms of Stress

According to the Harvard Medical School Family Health Guide, symptoms of chronic stress can affect us physically, behaviorally, emotionally, and cognitively

Physical symptoms of stress include:

- Headache***
- Backache
- Indigestion
- Tight neck and shoulders***
- Racing heart
- Tremors/Nervous tics
- Xerostomia***

- Lethargy/Fatigue
- Bruxism
- Skin disorders
- Susceptibility to illness***
- Heartburn/GI upset

Behavioral symptoms include:

- Increased smoking, alcohol or drug intake
- Compulsive eating
- Inability to get things done
- Reappearance or aggravation of phobias
- Avoidance of people or places
- Relationship problems
- Increased caffeine intake
- Impulsivity
- Overeating
- Bossiness

Emotional symptoms include:

- Crying
- Nervousness
- Edginess
- Loneliness
- Sense of powerlessness
- Low self-esteem
- Anger
- Guilt
- Suspicion
- Fear of failure
- Feelings of impending doom

Cognitive symptoms include:

- Trouble thinking clearly
- Forgetfulness
- Inability to make decisions
- Thoughts of escape
- Easily distracted
- Low threshold of frustration
- Anxiety and fears
- Lack of creativity
- Incessant worrying

According to the National Mental Health Association, 75 to 90% of all doctor's appointments are related to stress

Because most physicians do not have the time or resources to help discover and eliminate the sources of stress, they often prescribe medication

Common sources of Stress

- Environment
- Social stressors
- Physiological source
- Thoughts
- Belief System
- **Infection******

Scientists have discovered that a period of stress will disrupt a wide variety of immune functions such as:

- Formation of new lymphocytes and their release into the circulation
- The time preexisting lymphocytes stay in the circulation
- The manufacture of antibodies in response to an infectious agent
- Communication among lymphocytes (“cytokines”)

The best-documented way in which such immune suppression occurs is via glucocorticoids such as cortisol

Glucocorticoids inhibit the release of certain cytokines such as interferons and interleukins

Headliners: Stressful Times Have People Grinding Their Teeth; As reported by Camille Sweeney; New York Times News Service; appearing in the Idaho Statesman; 10/12/09

‘We’re finding in a lot of double-income families, we have the people who have lost jobs and are worried, and then we have the spouse, who still has the job, with the added pressure and uncertainty.

This can cause some real grinding at night.’--Dr. Gerald McCracken; San Diego dentist

Some grinders will brux up to 40 minutes of every hour during sleep—which can quickly erode enamel, fracture teeth, affect bite, damage the temporomandibular joint, and cause pain in the jaw, face, and ears

With or without economic hardship, 10% to 15% of adult Americans moderately to severely grind their teeth—and, along with genetics, stress has been recognized as a source for nocturnal bruxing--Source: Dr. Matthew Messina; dentist; consumer adviser for the American Dental Association

KEY:

- Because the body reacts to stress with a spurt of energy that enables a person to run or fight, people who are under stress burn that excess energy off somewhere—some do it at night by clenching or grinding their teeth--Source: Messina

Efforts to control stress can have a positive impact on the development and duration of TMDs

Meet Dr. Susan Maples, DDS and her co-workers:

Some of the complimentary services they offer:

- Cervical neck pillow
- Heated aromatherapy neck pillow
- Heated blanket
- Personal aromatherapy (essential oils are placed on the patient bib)
- Massaging dental chair pad
- Lavender scented hand warming mittens
- Foot and hand massages
- Paraffin hand treatment and jewelry cleaning
- Personal CD player with choice of music from their CD library including relaxation and nature music
- Aromatherapy with massage
- Relaxation in a Chiropractic massage chair
- Upper body massage with massage therapist 10-20 minutes

- Facial massage
- To finish the visit, a warm face towel is provided

Services offered for a fee:

- Target massage 30 minutes
- Full body massage 60 minutes
- Hot stone massage 60 minutes
- Rejuvenating facial treatment 30 minutes

Headliners: Take It Easy & Reduce Tooth Loss!; Jeffrey Gross, DDS; associate clinical professor; Case School of Dental Medicine; as reported in Woman's World; 6/23/08

As many as 57% of recent studies linked stress to periodontal diseases—the leading cause of tooth loss 'A constant onslaught of cortisol depresses your body's ability to kill off damaging bacteria in the mouth, plus it dampens your immune system's ability to heal and repair tissue damage, allowing small gum problems to mushroom into bigger ones.'--Gross, J

Headliners: A Little Charcoal in the Operatory May Be the Ticket!

Ever notice how happy you feel after spending time outside?

It may be due to negative ions that enter the bloodstream and increase the body's output of serotonin To keep levels of this neurotransmitter high when an outside break is not an option, try placing several lumps of plain charcoal in a bowl in your work area

Charcoal emits infrared rays that morph moisture molecules in the air into negative ions—giving you a quick mood boost without leaving your chair!

The Healing Power of Nature

Recent investigations by Japanese researchers set out to study the effects of 'shinrin-yoku' (literally, 'forest bathing') on stress reduction

Study results:

- People who spent 40 minutes walking in a cedar forest had lower levels of stress-related cortisol than their cohorts who spent 40 minutes walking in a lab--Source: Yoshifumi Miyazaki; forest-therapy expert and researcher; Chiba University (Japan); results appearing in TIME; 25 JUL 2016

Researchers found that trees and plants emit aromatic compounds called **phytoncides**—when inhaled, these products can spur healthy biological changes similar to aromatherapy--Source: Dr. Qing Li; professor; Nippon School (Tokyo)

Benefits of Shinrin-yoku:

Lowers Blood Pressure

- A large June 2016 study found that ~10% of people with hypertension could get their high blood pressure under control if they spent just 30 minutes or more in a park each week—phytoncides lower BP by inhibiting the sympathetic 'fight or flight' response

Inspires Awe:

- In a 2015 study, researchers discovered that people who spent 60 seconds looking up at towering trees were more likely to report feeling awe—after which they were more likely to help a stranger than people that who looked at an equally tall building
- 'Experiences of awe attune people to things larger than themselves. They cause individuals to feel less entitled, less selfish, and to behave in more generous and helping ways.'--Source: Paul Piff; study investigator; University of California (Irvine)

Promotes Cancer-Fighting Cells

- In a 2010 study, researchers found that people who took two long walks through forests on consecutive days increased their Natural Killer ('NK') cell count 50% and NK activity was increased 56% (cellular activity remained 23% higher for the month following the walks!)

The relationship between nonverbal behaviors and patient perceptions of clinicians has been underexplored—an investigation was undertaken to better understand the relationship between nonverbal communication behaviors (eye contact and social touch) to patient assessments of the treating clinician (empathy, connectedness, and liking)

Researchers found that the length of an office visit and eye contact between clinician and patient were positively related to the patient's assessment of the clinician's empathy

The research team concluded that: 'Clinical environments designed for patient and clinician interaction should be designed to facilitate positive nonverbal interactions such as eye contact and social touch.

Specifically, health information technology should not restrict clinicians' ability to make eye contact with their patients.'

Headliners: Serotonin: What the Gut Feeds the Bones; As reported by Laura Bell; Science News; 6/6/09

It was discovered almost a decade ago that serotonin—the 'feel good' hormone also involved in learning and sleep—might be bad news for bone health

In Fall 2008, researchers found that the intestinal tract acts as a serotonin-bone command center—studying the 'crosstalk' between the skeleton and GI system may help in treating osteoporosis

Here's what is happening:

- Eating a meal stimulates a specific enzyme ('Tph1') to make serotonin in the gut
- Platelets move the newly made serotonin throughout the body and into the bone

KEY: In excess, serotonin can inhibit pre-osteoblasts from becoming osteoblasts while osteoclastic function is not affected

Following the discovery of a serotonin connection to the bone-forming osteoblasts, researchers began to worry about the more than 10% of Americans who take SSRIs ('Selective Serotonin Reuptake Inhibitors')

In an osteoporosis study involving ~6000 older men, those taking SSRIs had lower average bone density than those not on the antidepressants

A related study of postmenopausal women found that bone density declined in those taking SSRIs TWICE as fast as it did in women not taking the medication

'I think the major question right now is—if depressed people are going to be treated with SSRIs, are we subjecting them to risk of fracture?'--Michael Bliziotis, Oregon Health & Science University; Portland, OR

Direct Effects of Glucocorticoids on Bone = Increased bone resorption + Decreased bone formation

Headliners: U.S. Antidepressant Use Jumps 65% in 15 Years; Laura Pratt; lead investigator; CDC's National Center for Health Statistics (NCHS); results released 15 AUG 2017; as reported by HealthDay News; 15 AUG 2017; accessed on 23 OCT 2017 at: <http://klinikkok.com/uncategorized/u-s-antidepressant-use-jumps-65-percent-in-15-years/>

According to the CDC, the number of Americans who say they have taken an antidepressant over the past month rose by 65% between 1999 and 2014

The 2017 report is based on replies by more than 14,000 Americans—aged 12 and older—to a federal government health survey conducted between 2011 and 2014 (results were compared to those from prior surveys stretching back to 1999)

By 2014, about one in every eight Americans over the age of 12 reported recent antidepressant use Women are nearly TWICE as likely as men to be taking the medication—with antidepressants used by 16.5% of females compared to just under 9% of males

“Despite our society being progressive, there are still ongoing gender stigma related to seeking treatment for depression. It is more ‘OK’ for a woman to be depressed and seek out treatment for this, whereas men are supposed to be tough, suck it up and move on. One other possible confounder is that males, in my experience, are more upset by the sexual side effects associated with antidepressants—such as erectile dysfunction and delayed ejaculation—and could make them more reluctant to take these medications.”--Source: Dr. Seth Mandel; director of psychiatry; Northwell Health’s Huntington Hospital (Huntington, NY)

The researchers noted that ‘one-fourth of all people [surveyed] who took antidepressants over the past month reported having taken them for 10 years or more’

Why the steep rise in antidepressant use?

One explanation:

- ‘People have become increasingly stressed and depressed in our society. Social media continues to paradoxically cause people to be more isolated and out of touch with their feelings. In addition, direct-to-consumer advertising, coupled with an evolving societal mindset to just take a pill to make things better, both contributed to the growth in antidepressant use over this time period.’--Source: Dr. Seth Mandel; director of psychiatry; Northwell Health’s Huntington Hospital (Huntington, NY)

Xerostomia anyone?

Patients treated with antidepressant drugs often experience ‘dry mouth’

It was postulated that these drugs may cause salivary gland hypofunction or may alter the threshold for the perception of dry mouth—or they may do both

Older patients appeared to be more at risk of a drug-induced dry mouth due to greater salivary gland hypofunction--Source: Daly, Christopher: Oral and Dental Effects of Antidepressants. Australian Prescriber 39.3 (2016); accessed on 13 NOV 2017 at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4919175/>

Diabetes

‘Diabetes may well become the defining issue of global health for the next decade. We are not at the peak of this wave yet and, unlike high blood pressure and cholesterol, we still don’t have great treatments for diabetes.’--Majid Ezzati, MEng, PhD; Chair of Global Environmental Health; Imperial College (London)

Headliners: Three-year-old Among Youngest Ever to be Diagnosed with Type 2 Diabetes; As reported by Allison Vuchnich; Senior Network Correspondent; Global News; posted 18 SEP 2015; accessed 4 APR 2016 at: <http://globalnews.ca/news/2228110/three-year-old-among-youngest-ever-to-be-diagnosed-with-type-2-diabetes/>

At only three years old, an American toddler was one of the youngest patients ever to be diagnosed with Type 2 diabetes—Type 2 diabetes is associated with obesity, poor diet and lack of exercise

‘This is a global problem. Type 2 diabetes is no longer limited to adults. Now when I see any obese child I screen the patient for Type 2 diabetes.’--Dr. Michael Yafi; treating physician; in a comment to Reuters

KEY: Of the two types of diabetes, Type 2 diabetes displays the closest medical link between chronic inflammation and diabetes

Evidence has consistently indicated that diabetes is a risk factor for increased severity of gingivitis and periodontitis—and, conversely, periodontitis may be a risk factor for worsening glycemic control among patients with diabetes and may increase the risk of diabetic complications

Periodontal diseases involve activation of the broad axis of innate immunity through upregulation of proinflammatory cytokines from monocytes and neutrophils—including interleukin (IL)-1 β , IL-6, IL-8, tumor necrosis factor alpha (TNF- α) and **prostaglandin E2*****

These 'locally' produced cytokines move into the systemic circulation, where they may perpetuate an elevated inflammatory state—worsening the patient's diabetes through increasing insulin resistance and glucose levels

The inflammatory mediators originating from periodontal sources can interact systemically with lipids, free fatty acids and advanced glycation end products (AGEs)—all of which are characteristic of diabetes
Innate Immunity, Periodontitis and

Type 2 Diabetes Mellitus

This interaction induces or perpetuates activation of the intracellular pathways which are associated with insulin resistance—specifically, the activation of inflammatory pathways in immune cells (monocytes or macrophages), endothelium cells, adipocytes, hepatocytes and muscle cells promotes and contributes to an increase in overall insulin resistance

Insulin resistance makes it difficult to achieve metabolic control in patients with both type 2 diabetes and periodontitis

Headliners: Inflammation Markers May Be More Accurate Than Weight at Predicting Type 2 Diabetes; Posted 29 Aug 2013 on Diabetes.co.uk; accessed on 4 Apr 2016 at:

<http://www.diabetes.co.uk/news/2013/Aug/inflammation-markers-may-be-more-accurate-than-weight-at-predicting-type-2-diabetes-93240187.html>

Researchers from University College Cork evaluated data on 2,047 people who took part in the Cork and Kerry Diabetes and Heart Disease Study—specifically, the study reviewed data on a number of inflammatory markers including C-reactive protein, TNF- α , interleukin 6, plasminogen activator inhibitor-1, adiponectin levels and white blood cell counts

Their findings: Participants with higher white blood cell counts and levels of acute-phase response proteins were more likely to have metabolic disorders such as insulin resistance and evidence of heart disease than participants that were obese and non-obese

Additionally, those participants that were obese and healthy demonstrated healthy levels of inflammation markers

Headliners: Inflammatory Markers and Risk of Type 2 Diabetes: A systematic review and meta-analysis; Xia Wang, MD, PHD et al; received April 12, 2012; accepted July 26, 2012; posted on Diabetes Care (American Diabetes Association); accessed on 4 Apr 2016 at:

<http://care.diabetesjournals.org/content/36/1/166.full>

This meta-analysis provided further evidence that elevated levels of IL-6 and CRP are significantly associated with increased risk of type 2 diabetes

Headliners: Oral Mucosal Lesions in Non-Oral Habit Diabetic Patients and Association of Diabetes Mellitus with Oral Precancerous Lesions; Source: Rajan Sainia, lead study author; study results appearing in Diabetes Research and Clinical Practice; 89(3): p.320-326. September 2010

Researchers found a significantly greater proportion of subjects with diabetes (45%) had one or more oral mucosal lesions ('OML') in comparison to non-diabetics (38.3%)

Diabetic patients demonstrated a significantly greater prevalence of geographic tongue, denture stomatitis and angular cheilitis than non-diabetics ($p < 0.05$)

The results also showed an association between occurrence of one or more OML and metabolic control of diabetic patients ($p < 0.05$)

Treating type 1 diabetes and some cases of type 2 diabetes has long required painful and frequent insulin injections or a mechanical insulin pump for insulin infusion

But researchers from the University of North Carolina and NC State have now developed what could be a much more patient-friendly option: artificial cells that automatically release insulin into the bloodstream when glucose levels rise

Researchers reported a single injection of the artificial beta cells ('AβCs') into diabetic mice lacking beta cells quickly normalized the animals' blood glucose levels and kept those levels normal for up to five days

'Our plan now is to further optimize and test these synthetic cells in larger animals, develop a skin patch delivery system for them, and ultimately test them in people with diabetes.'--Source: Zhen Gu, PhD; lead investigator; professor; Joint UNC/NC State Department of Biomedical Engineering; study results accessed on 11/13/2017 at: <https://www.sciencedaily.com/releases/2017/10/171030131454.htm>

At least six million people in the United States use insulin as a diabetes treatment (either by injection or a mechanical pump)—delivery of insulin orally has been challenging due to the proteinaceous nature of the molecule (it is destroyed by digestive enzymes and acids before it reaches the bloodstream when administered in pill form)

Headliners: Further Support for Diagnosing Diabetes at the Dentist; Source: Miriam E. Tucker; reporting for MedScape Medical News: posted 26 MAY 2015; accessed 2 APR 2018 at: https://www.medscape.com/viewarticle/845324#vp_1

At the American Association of Clinical Endocrinologists' 2015 Annual Scientific and Clinical Congress, a study was presented by Saleh Aldasouqi, MD, that aimed to validate a diabetes screening tool specific to dentists' offices

The 14-item questionnaire was developed by study coauthor Susan Maples and is one of several online screening tools she has developed for use specifically in the dentist's office—including those aimed at identifying patients at high risk for medical conditions with oral involvement such as obstructive sleep apnea and acid reflux

In the study, a total of 500 patients (302 women and 198 men) with a mean age of 48 years completed the survey and underwent a validated fingerstick test for HbA1c—which identified 1.2% (six patients) with diabetes and 19.2% (96 patients) with prediabetes

Predictors of diabetes/prediabetes from the questionnaire included age, being 10% over ideal body weight, waist size above 40" for men or 35" for women, hypertension, abnormal lipids, tingling of hands or feet, and visual symptoms or conditions (ie, blurring, cataracts, glaucoma)

The idea stems from the fact that many people who regularly see dentists do not necessarily see their physicians as often—the questionnaire is designed to be completed when the health history is updated. Those patients who score positively would then be referred to their physician for follow-up

Oral Inflammation and Cancer

Inflammation caused by specific oral pathogens has led to some breakthrough findings in the war on cancer

HPV is a virus from the papillomavirus family that affects human skin and mucous membranes (including the throat and oral cavity)

There are many, many types of HPV—some types can cause verrucae (warts) and a few strains have been shown to increase the risk of certain cancers (cervix, penis, vagina, anus and oropharyngeal area***)

The HPV 16 and 18 strains—which are known to cause nearly all cases of cervical cancer—raise the risk of developing oropharyngeal (throat) cancer

Researchers from UB and Roswell Park Cancer Institute published the first study showing an association between long-standing periodontitis and risk of tongue cancer in 2007—the UB researchers also demonstrated that the periodontitis and HPV-infection appear to work in tandem to boost the chances of developing tongue cancer the following year

'Evidence of periodontitis-HPV synergy has important practical implications because there is a safe treatment for periodontitis, but no treatment for HPV infection. If these results are confirmed by other

studies, this has a tremendous relevance in predicting and intervening in the initiation and prognosis of HPV-related diseases, including head and neck cancers.’--Mine Tezal, D.D.S., Ph.D., assistant professor in the Department of Oral Diagnostic Sciences, UB dental school, and research scientist at Roswell Park Cancer Institute

Oral Cancer

More than 34,000 Americans will be diagnosed with oral or pharyngeal cancer this year—it will cause over 8,000 deaths, killing roughly 1 person per hour, 24 hours per day

Of those 34,000 newly diagnosed individuals, only half will be alive in 5 years—this is a number which has not significantly improved in decades

The death rate for oral cancer is higher than that of cancers which we hear about routinely such as cervical cancer, Hodgkin's lymphoma, laryngeal cancer, cancer of the testes, endocrine system cancers such as thyroid, or skin cancer (malignant melanoma)

The death rate associated with oral cancer is particularly high not because it is hard to discover or diagnose, but due to the cancer being routinely discovered late in its development

In order to discover pathology, you must first look for it

Manual palpation in combination with intraoral camera use is the ticket!

Often it is only discovered when the cancer has metastasized to another location—most likely the lymph nodes of the neck

Oral cancer is particularly dangerous because in its early stages it may not be noticed by the patient, as it can frequently prosper without producing pain or symptoms they might readily recognize

There are several types of oral cancers, but around 90% are squamous cell carcinomas

It has now been confirmed that younger age groups, including those who have never used tobacco products, have oral cancer which is HPV viral based

High-risk HPV strains cause cancer by using special proteins to disrupt healthy cells—it makes cells unable to repair themselves and unable to control how they are duplicated

There are forms of HPV (specifically HPV-16, HPV-18, HPV-31, and HPV-45) which are sexually transmitted and are a serious problem

The most dangerous sexually transmitted HPV's (16 and 18) are known to cause up to 95% of cervical cancers—now these two HPV's are also being linked to oral cancer

The human papilloma virus, particularly version 16, has been shown to be sexually transmitted between partners—and is conclusively implicated in the increasing incidence of young non-smoking oral cancer patients

Based on peer reviewed published data, in people under the age of 50, HPV may even be replacing tobacco as the primary causative agent in the initiation of the disease process

Johns Hopkins' researchers reported in a study published in the February 2008 Journal of Clinical Oncology that between 1973 and 2004 the incidence of HPV-related oral cancers among people in their 40s nearly doubled—today 39% percent of oral cancer cases are related to HPV--American Cancer Society

‘These are patients that are young. They are in their 30s and 40s. They are nonsmokers, and they don't drink alcohol excessively. And every time we look we are able to find HPV-16 in their tissue, in the biopsy specimen.’--Dr. Robert Haddad, a Dana Farber Cancer Institute head and neck surgeon

The virus is transmitted by direct contact—HPV is transmitted only in the location it attaches to and never travels through the bloodstream—how it is infecting the mouth reflects a disturbing trend

‘There is absolutely a link between oral sex and oral cancer.’--Dr. Ellen Rome, Cleveland Clinic

From a gender perspective, for decades this has been a cancer which affected 6 men for every woman—that ratio has now become 2 men to each woman

One more HPV Tidbit: According to recent studies, HPV infection can also raise cardiovascular disease risk

Meet Porphyromonas Gingivalis

As a non-motile, Gram-negative, rod-shaped, anaerobic organism, *P. gingivalis* has surface fimbriae which allow the bacteria to adhere ('stick') to epithelial AND tooth surfaces making it a very important pathogen for periodontal diseases

The main feature of periodontal diseases is inflammation of oral tissues in response to Gram negative pathogenic bacteria such as *Porphyromonas gingivalis*—an increase in secretion of gingival crevicular fluid ('GCF') accompanies the inflammatory response

The rise in GCF raises the local pH which allows periopathic bacteria such as *P. gingivalis* to overgrow and crowd out other microbes

P. gingivalis, as a hemin-dependent bacteria, enjoys the hemin that is abundantly found in GCF—the increased production of GCF accompanying inflammation of periodontal tissues provides a competitive advantage to the so-called 'red-complex' bacteria (of which *P. gingivalis* is a member) over commensals

A recent investigation demonstrated that *Porphyromonas gingivalis* was present in 61% of study participants with esophageal squamous cell carcinoma (ESCC)--Source: Gao S et al: Presence of *Porphyromonas gingivalis* in esophagus and its association with the clinicopathological characteristics and survival in patients with esophageal cancer; *Infect Agent Cancer* (2016); 11: 3. Published online 2016 Jan 19; accessed on 3/14/16 at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4717526/>

The researchers also found the presence of *P. gingivalis* correlated with other factors—including cancer cell differentiation, metastasis and overall survival rate

There are two likely explanations: either ESCC cells are a preferred niche for *P. gingivalis* to thrive or the infection of *P. gingivalis* facilitates the development of esophageal cancer

'These findings provide the first direct evidence that *P. gingivalis* infection could be a novel risk factor for ESCC and may also serve as a prognostic biomarker for this type of cancer. These data, if confirmed, indicate that eradication of a common oral pathogen may contribute to a reduction in the significant number of people suffering with ESCC. It would suggest that improving oral hygiene may reduce ESCC risk; screening for *P. gingivalis* in dental plaque may identify susceptible subjects; and using antibiotics or other anti-bacterial strategies may prevent ESCC progression.'--Source: Huizhi Wang; University of Louisville; School of Dentistry

Research has documented that the higher the levels of C-reactive Protein ('CRP'), the poorer the prognosis for a variety of malignancies (multiple myeloma, melanoma, lymphoma, sarcoma as well as cancer of the ovaries, kidney, pancreas and gastrointestinal system)

Oral Health and Nutrition

Position Paper of the Academy of Nutrition and Dietetics: eatrightPRO; Volume 113 (5); p. 693-701; 5/2013; accessed on 8/15/2017 at: <http://www.eatrightpro.org/resource/practice/position-and-practice-papers/position-papers/oral-health-and-nutrition>

The Academy of Nutrition and Dietetics urges you to visit eatright.org for more information on healthful eating or to find a registered dietitian nutritionist

It is the position of the Academy of Nutrition and Dietetics that nutrition is an integral component of oral health—the Academy supports integration of oral health with nutrition services, education and research

The provision of medical nutrition therapy—including oral and overall health—is incorporated into the Standards of Practice for registered dietitians and dietetic technicians

'Inclusion of didactic and clinical practice concepts that illustrate the role of nutrition in oral health is essential in education programs for both professional groups'

Oral health and nutrition have a multifaceted relationship—oral infectious diseases as well as acute, chronic and systemic diseases with oral manifestations impact an individual's functional ability to eat and their nutrition status

Likewise, nutrition and diet can affect the development and integrity of the oral cavity and progression of oral diseases

As knowledge of the link between oral and nutrition health increases, dietetics practitioners and oral health care professionals must learn to provide screening, education and referrals as part of comprehensive client/patient care

'Collaborative endeavors between dietetics, dentistry, medicine and allied health professionals in research, education and delineation of practice roles are needed to ensure comprehensive health care. The multifaceted interactions between diet, nutrition and oral health in practice, education and research in both dietetics and dentistry merit continued, detailed delineation.'--Position statement of the Academy of Nutrition and Dietetics

In order to maintain the integrity of the periodontal ligament, collagen synthesis and degradation must be equal

Unlike bone where formation is dependent on one type of cell ('osteoblast') and breakdown is achieved by another ('osteoclast'), the remodeling of collagen is the sole responsibility of the fibroblast

KEY: Because of the exceptionally high rate of collagen turnover in the periodontal ligament, any interference in fibroblast function rapidly produces a loss of tooth support

Collagen in Review:

- Collagen is the most common protein in the human and is found in all connective tissue and hard structures such as bone, teeth and cartilage
- It has a triple-helix formation which gives it stability—the formation of the helical structure of collagen is dependent on vitamin C
- Prolyl hydroxylase is an enzyme which is required to form hydroxyproline which stabilizes the collagen's triple-helix structure by forming interstrand hydrogen bonds
- In order to function properly, this enzyme requires vitamin C
- Unlike most other animals, humans (as well as guinea pigs) cannot synthesize L-ascorbic acid (vitamin C) and require dietary supplies of this nutrient in order to maintain healthy collagen and happy fibroblasts

The clinical manifestations of vitamin C deficiency are primarily due to abnormal collagen synthesis—collagen lacking hydroxyproline is more fragile and contributes to the clinical manifestations of this nutritional insufficiency

Oral Manifestations of Scurvy

- Gingival swelling with purplish, spongy edema
- Gingival bleeding
- Friable tissue
- Infections common

Typically, scurvy carries an excellent prognosis if diagnosed and treated appropriately—a supplement of 250 mg ascorbic acid by mouth four times daily in addition to a diet rich in FRESH fruit and vegetables generally relieves symptoms within two weeks

Patients at Risk for Vitamin C Deficiency:

- Infants fed only cow's milk during first year of life
- Adults 55+ years of age (especially males; 'tea-and-toast diets')
- Cigarette smokers

- Pregnant and lactating women
- Thyrotoxicosis (excess thyroid hormone)
- Anorexia
- Type 1 diabetes
- Diseases of the small intestine (Crohn's, Whipple, celiac disease; also gastric bypass) NOTE: Vitamin C is absorbed in the small intestine
- Boiling fruit products
- Low SES
- Chronic inflammation

Headliners: Images Probe Artery-Hardening Plaques; Hutcheson JD et al; Nature Materials (2016); as reported by Tina Hesman Saey; Science News Magazine; 189 (4); 20 Feb 2016; accessed 5 Sep 2016 at: <https://www.sciencenews.org/article/images-probe-artery-hardening-plaques>

Collagen apparently also protects against loose bits of atherosclerotic plaque that can lead to cardiovascular events

A bit of background:

- Endothelial cells lining blood vessels secrete tiny spheres ('extracellular vesicles') filled with calcium and phosphate which fuse into calcified plaques under a protective collagen coating
- The plaque poses little risk if the collagen layer is not disturbed

But when macrophages invade the area, they secrete chemicals that break down collagen and 'poke holes in the safety net'

As a result, the vesicles clump into smaller, less stable plaques that are more prone to 'breaking away' Researchers from Harvard Medical School were able to capture images of human arteries hardened by atherosclerotic plaque—the images illustrated the importance of collagen within the plaque

In the study, researchers found different arrangements of plaque deposited along arterial walls—stable plaques demonstrated an outer layer of collagen which protected the plaque; smaller clumps of collagen-covered plaques were more vulnerable to breaking away

MICROBIAL CHALLENGES

A look back in time:

- 'It is plaque MASS that overwhelms the body's ability to control detrimental effects to the oral cavity'
- Dogma was that all bacterial deposits had equal potential to induce disease
- Tissue damage occurred when plaque accumulation overcame host's ability to defend
- Dental plaque has been known to be a reservoir of microorganisms since van Leeuwenhoek first described them in 1683
- Dentistry embraced Koch's postulates (One Organism=One Disease) and attempted to link specific microbes (like *Streptococcus mutans*) with particular dental diseases (caries)

Interestingly, until the 1980's it was assumed that microbes predominantly live in a suspended phase—in fact, most studies on microbial diseases and mechanisms of drug-resistance were based on the 'planktonic' mode of growth

In the 1970's, researchers led by John William Costerton demonstrated that microorganisms prefer a 'community lifestyle' as opposed to 'singledom'—and the researchers used dental plaque as one of the first few samples in these ground-breaking studies

Use of the metagenomics approach to identify the diversity of microorganisms associated with dental plaque biofilm has indicated that the number of bacterial species in a mature dental plaque biofilm could be as high as 19,000!--Seneviratne CJ et al: Dental Plaque Biofilm in Oral Health and Disease. The Chinese Journal of Dental Research; 14(2): 2011

One of the truly remarkable features of microbial biofilm is its self-sustainability—a microbial biofilm can survive under highly challenging environmental conditions that its planktonic counterparts cannot. Bacteria communicate by mediating small molecules which are involved in both intra- and interspecies communication among the biofilm members.

Two examples of ‘communication mediators’ are **competence stimulating peptide (‘CSP’)** and **autoinducer-2 (‘AI-2’)**

CSP is produced by many streptococcal species and is instrumental in such activities as biofilm formation, antimicrobial resistance, and acid tolerance of dental plaque biofilm.

AI-2 plays a key role in both inter- and intraspecies communication and expression of virulence factors.

Healthy Plaque: Is there such a thing?????

Healthy dental plaque biofilm is predominantly composed of commensal, non-pathogenic microbial members—and they talk a lot among themselves AND host tissues (like gingiva).

In this harmonious, mutually beneficial relationship, the host provides a colonization surface for the commensals and the bacteria provide ‘colonization resistance’ against pathogenic, more harmful organisms.

Interestingly, *Streptococcus salivarius* has been shown to inhibit quorum sensing and biofilm formation of *Streptococcus mutans*—which may help explain why *S. salivarius* has been identified as having ‘caries protective features’.

KEY CONCEPTS:

- Commensal (symbiotic) bacteria in plaque contribute to the development of a NORMAL immune system by constantly providing a variety of bacterial antigens for the host’s innate immune system.
- Commensals produce messages of tolerance—contrasting with pathogenic bacteria which produce a strong inflammatory response in the host.

Streptococcus mutans

Long implicated as being a major player in caries formation, *Streptococcus mutans* is a microbe that continues to be studied intensively in the oral health field.

Despite scientific advancements in cariology in the past 150 years, dental caries remains a serious issue worldwide—particularly in children where it is the primary source of tooth loss.

In the United States, 42% of children between the ages of 2 to 11 have had dental caries in their primary teeth and, in the adult population, dental caries and periodontal diseases affect 60–90% of individuals worldwide--Source: Rouabhia M and Chmielewski W: Diseases associated with oral polymicrobial biofilms. *Open Mycol J* 6: 27–32. (2012)

Understanding the mechanisms behind caries generation involving *Streptococcus mutans* is crucial in order to control, prevent and treat dental caries.

An important virulence factor for any microbe is its ability to adhere to biological structure—understanding of how *Streptococcus mutans* ‘sticks’ to tooth surface is a key factor in caries control.

The process of plaque biofilm formation begins with the formation of salivary pellicle specifically adsorbed to the acquired enamel pellicle (AEP)—single *S. mutans* cells or their aggregates fuse with pellicles via two independent mechanisms: sucrose-dependent and sucrose-independent--Source: Krzyściak W et al: The virulence of *Streptococcus mutans* and the ability to form biofilms; *European Journal of Clinical Microbiology & Infectious Diseases*; April 2014, Volume 33, Issue 4, pp 499-515; posted online 10/24/13; accessed 3/10/16 at: <http://link.springer.com/article/10.1007/s10096-013-1993-7/fulltext.html#CR30>

The sucrose-dependent mechanism of plaque formation is based on glucosyltransferases ('GTFs') produced by *S. mutans* in combination with glucan-binding proteins ('GBPs')—GTFs play critical roles in virulent dental plaque development and are responsible for glucans formation from sucrose. Researchers from the UK and Japan were able to re-create the 3D structure of an enzyme that plays a key role in tooth decay caused by *S. mutans*—Source: Keisuke Ito et al: Crystal Structure Of Glucansucrase From The Dental Caries Pathogen *Streptococcus mutans*; appearing in the *Journal of Molecular Biology*; 408 (2):pp. 177-378. 4/29/11

The structural information provides critical insight into how the enzyme 'GTF-SI'—a glucansucrase—catalyzes glucan development leading to plaque biofilm development.

The synthesized glucans provide the possibility of both bacterial adhesion to the tooth enamel and microorganisms to each other—a mechanism that favors the formation of biofilm.

Investigations involving *S. mutans* cells proved that they exhibit a different expression of some proteins in comparison to planktonic cultures and were associated with a higher tolerance to low pH as compared to planktonic cultures—allowing them to thrive in an acidic biofilm necessary for caries development.

A previously unidentified strain of streptococcus (called 'A12') was found to neutralize acid by metabolizing arginine—additionally, A12 inhibited growth and intercellular signaling pathways of *Streptococcus mutans*.

With hopes of developing an A12 oral supplement, the researchers stated that 'A12-like organisms may play crucial roles in promotion of stable, health-associated oral biofilm communities by moderating plaque pH and interfering with the growth and virulence of caries pathogens'—Source: Huang X et al: Characterization of a highly arginolytic *Streptococcus* species that potentially antagonizes *Streptococcus mutans*; *Applied and Environmental Microbiology*; accepted manuscript posted online 29 January 2016; accessed on 3/14/16 at: <http://aem.asm.org/content/early/2016/01/25/AEM.03887-15>

The research team recently received a five-year, \$3 million grant from the U.S. National Institute of Dental and Craniofacial Research to study A12 and related bacteria in the mouth.

The ability of bacteria of the *S. mutans* species to form biofilms is significant in the context of caries etiology—*Streptococcus mutans* are also implicated in the development of **infective endocarditis (IE)**. In an intensive review exploring the virulence potential of *Streptococcus mutans*, researchers found that strains of *S. mutans* may cause the aggravation of **ulcerative colitis**—and may indeed be involved in the pathogenesis of ulcerative colitis—Source: Kojima A et al: Infection of specific strains of *Streptococcus mutans*, oral bacteria, confers a risk of ulcerative colitis; *Nature Scientific Reports* 2, Article number: 332 (2012); published online 26 March 2012.

'We clearly showed that infection of specific strains of *S. mutans* is one of the risk factors in aggravating inflammation of ulcerative colitis ('UC'). This is the first report describing the involvement of oral bacteria in UC pathology.'—Statement from the study investigators.

Investigators further proposed direct evidence of uptake of oral bacteria by hepatocytes—since the majority of liver cells are hepatocytes, bacterial uptake by hepatocytes may be the most important step in causing the aggravation of further inflammatory responses.

KEY: When organized in biofilms, bacteria produce substances which individual bacteria alone cannot produce

Headliners: Rattlesnake-type Poisons Used by Superbug Bacteria to Beat Our Defenses
ScienceDaily; 9/9/08

Scientists found that biofilm bacteria can produce a protein which their analysis suggests is similar to one of the active ingredients in rattlesnake venom.

In the case of rattlesnake venom, the protein causes the host cells to commit suicide and die—which is one reason rattlesnake bites are so dangerous

In the case of the ‘superbug’ *Pseudomonas aeruginosa*, biofilms of this microbe make venom-like proteins that attack our immune cells

‘We found that, in contrast to expectations, biofilms do indeed produce harmful chemicals. However, the type of tissue-degrading enzymes and toxins made by the biofilm bacteria differ from those produced by free-floating bugs, which may help them to survive attacks by our immune systems.’--Dr. Martin Welch; study director; University of Cambridge (UK); presenting at the Society for General Microbiology’s Autumn meeting held at Trinity College; Dublin; 9/8/08

So how do we attack a plaque biofilm?????

Ultrasonic (office) and sonic (home) technology may just be our best weapon against biofilms

As clinicians, our goal is to regenerate ALL of the components of the periodontium through periodontal therapy

The members of the Periodontium:

- Gingiva
- Periodontal ligament
- Cementum
- Bone

Cementum

Less is known about cementum than any other supportive tissue

We do know that without root cementum, fiber attachment cannot occur

Bone

Guided Tissue Regeneration

- A barrier (newer types are absorbable and antimicrobial) is used to prevent epithelial cells from migrating to the surgical site and repairing the ‘wound’ by generating a long junctional epithelium
- The barrier provides a secluded space for inward migration of periodontal ligament cells and mesenchymal cells on the exposed root surface

Generation of bone through **grafting procedures** is fast becoming a periodontal therapy option for a variety of defects

Headliners: Dental Bone Graft and Substitutes Market to Surpass US\$ 911.4 Million Threshold by 2025 Globally; Source: Healthcare Journal; Seattle, WA; posted 22 MAR 2018; accessed 2 APR 2018 at: <https://journalhealthcare.com/50331/dental-bone-graft-and-substitutes-market-to-surpass-us-911-4-million-threshold-by-2025-globally/>

Dental bone grafts are used as fillers or scaffolds that facilitate bone formation and helps in the wound healing and are suitable for a variety of clinical procedures such as filling of sockets, preservation of ridge volume (also referred to as ‘ridge preservation’), and osteogenesis

The global dental bone graft and substitutes market was valued at US\$ 418.4 million in 2016 and is expected to witness a robust compound annual growth rate (‘CAGR’) of 9.1% over the forecast period of 2017–2025

Types of Bone Grafts

- Autograft
- Allograft
- Alloplasts
- Xenograft

Autografts

- Often referred to as the 'gold standard'
- Bony tissue transplanted from one site to another within the same individual
- May be extraoral (typically iliac cancellous bone and marrow) or intraoral (maxillary tuberosity)

Allografts

- Defined as a tissue graft between individuals of the same species but of non-identical genetic composition
- Bone source is typically cadaver bone that has undergone several treatment sequences to avoid disease transmission and decrease immune reactions

Alloplasts

- Refers to synthetic, chemically derived bone substitute
- Most often a form of calcium phosphate
- May be absorbable or nonabsorbable

Xenografts

- Tissue graft between two different species
- Typically bovine-derived
- Calcium phosphate is responsible for the mechanical strength and development of bone
- Once processed, the material is termed anorganic bovine bone mineral (ABM)

PepGen P-15 is a bone graft material that mimics autogenous bone

As an anorganic bovine material (ABM), it has the same mineral composition as human bone and additionally has a synthetic biomimetic of the 15 amino acid sequence that contains the potent cell-binding domain of Type 1 collagen

It has been demonstrated that this sequencing of amino acids enhances cell attachment and extracellular matrix and factor production—resulting in the formation of bone

Periodontal Stem Cells

- Stem cells are immature, undifferentiated cells that can divide and multiply for an extended period of time and are capable of morphing into at least two different types of cells
- In 2000, the National Institute of Health announced the discovery of adult stem cells in impacted third molars*** and even more resilient stem cells in deciduous teeth***—providing hope for future regeneration of tooth structure and salivary glands as well as orofacial bone and cartilage

Periodontal Ligament Stem Cells ('PDLSCs'):

- Periodontal ligament stem cells (PDLSCs) are isolated from the separated PDL of the roots of impacted human third molars and have the capability to differentiate into adipogenic, osteogenic, and chondrogenic progenitor cells in in vivo experiments
- Once tissue destruction has occurred, one of the major goals of periodontal therapy is to regenerate the affected tissues to their original architecture and function
- Many surgical procedures have been advocated for periodontal regeneration including guided tissue regeneration ('GTR') and bone grafting procedures—utilizing stem cell therapy may offer a less invasive treatment

Stem Cells in Human Exfoliated Deciduous Teeth ('SHED')

In the year 2003, Dr. Songtao Shi, D.D.S., Ph.D.; professor; Ostrow School of Dentistry; University of Southern California (Los Angeles), was able to isolate, grow, and preserve tooth stem cell's regenerative ability, by using the deciduous teeth of his six-year-old daughter—he called the cells 'SHED' ('Stem cells in Human Exfoliated Deciduous teeth')

Recent studies have shown that these stem cells from human exfoliated deciduous teeth have a greater ability to develop into various types of body tissues compared to other types of stem cells

Because of their pluripotent capabilities, banking of SHED has become common for a variety of reasons:

- Provides an autologous transplant for life
- Simple and painless harvesting procedure
- SHED cells are complementary to stem cells from the cord blood
- Useful for close relatives of the donor
- Not subjected to the same ethical concerns as embryonic stem cells

Something to keep in mind:

- Teeth that are 'hanging on by a thread' are not suitable for SHED harvesting

While the new horizons in periodontal therapy continue to expand, we need to keep abreast of current scientific breakthroughs and new product developments

THANK YOU!!!