Oral Pathogens: A Common Cause of Chronic Disease

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Abstract *The current medical literature now clearly demonstrates that the pathogens found in root canal–treated teeth and chronic gum disease are the direct causes for the vast majority of heart attacks today. Less concretely established, it also appears that these same dental pathogens are often the direct cause of most cases of breast cancer and a strong contributing factor to strokes secondary to ruptured cerebral aneurysms. Other infected teeth are often asymptomatic but are even more toxic than root canal–treated teeth. Detectable only by X-ray, teeth with evidence of chronic apical infection are actually not uncommon, and the importance of actively looking for such infected teeth is extremely important in the patient with any chronic degenerative disease, but especially coronary heart disease. The problems with cavitations and dental implants are also discussed, along with the common denominator linking their infectious toxicity to that of chronically infected teeth. The importance of any degree of hypothyroidism as a facilitating agent for allowing the spread of dental pathogens, especially into the coronary arteries, is also addressed. A general treatment protocol for approaching chronic degenerative diseases is discussed, along with the absolute need for increased cooperation and coordination between physicians and dentists for the optimal treatment of their patients. Dentists need to refer their root canal treatment patients to physicians for cardiac evaluations, and cardiologists, internists, and general practitioners simply must make a dental evaluation for infected teeth a routine part of the workup in their cardiac patients.*

Redox Biology and Chronic Disease

Promoters of chronic degenerative disease all share the common denominator of causing, directly or indirectly, increased oxidative stress in the tissues and organs involved in the disease process. Increased oxidative stress results when the ongoing production of free radicals and other pro-oxidant molecules exceeds the capacity of the antioxidant stores to neutralize them and/or repair the oxidative damage they have inflicted (Halliwell, 2006). Such an increase in oxidative stress is characterized by the presence of abnormally high levels of oxidized biomolecules that are crucial for normal cellular function, such as enzymes, proteins, lipids, sugars, and even nucleic acids.

The oral cavity is a source of pathogens and toxins for very many people, especially those with chronic degenerative diseases. All pathogens and toxins cause cellular damage and disease via the mechanism of increasing oxidative stress. Furthermore, all toxins are pro-oxidant, and all pro-oxidants are toxic. They are literally synonyms. At the molecular level, then, all toxins result in targeted biomolecules becoming oxidized, meaning they are depleted of elec-

trons. Conversely, all antioxidants are antitoxins because they donate electrons, sometimes directly quenching the electron-seeking toxins or just restoring a full complement of electrons to previously oxidized biomolecules (reduction). All quality nutrients are "nutritious" only to the degree that they ultimately metabolize down to antioxidant, electron-donating agents at the molecular level.

Even though the final common denominator of all disease is increased oxidative stress, the great variety in the clinical expression of diseases results from the characteristics of the increased oxidative stress and the chemical nature of the toxin. The increased oxidative stress has the variables of which cells and tissues are affected, underlying genetic predispositions to oxidation, the chronicity and the degree of the increased oxidation, and the biochemical nature of the toxin. The more important variables of the disease-causing toxin involve its solubility (water versus fat), molecular size, ionic charge, accumulative mass, the types of biomolecules to which the chemical configuration of the toxin is most attracted, and how tightly the toxin holds on to the electrons it acquires. Holding on to the electrons acquired is a very important measure of toxicity, as this affinity largely determines how significantly healthy electron exchange and electron flow, in the form of biological microcurrents, is affected. All of these considerations regarding antioxidants and toxins come under the umbrella of redox (reduction-oxidation) physiology.

Sources of Increased Oxidative Stress

With the central role of increased oxidative stress in disease in mind, most prominent promoters of chronic degenerative disease come under one or more of the following categories:

1. Acute and chronic infections, which produce endotoxins, exotoxins, and multiple toxic metabolic byproducts
2. Ongoing exogenous toxin exposures
3. Accumulated toxins from all sources, with particular attention to excess iron and calcium
4. Dietary/poor digestion toxin exposure (more putrefaction, less digestion)
5. Abnormally low hormone levels, especially thyroid, and testosterone or estrogen
6. Poor to absent intake of quality supplementation

This list of the prominent promoters of chronic degenerative disease leads to the primary treatment principles for all such diseases:

1. To prevent or minimize new daily toxin exposures, often of dental, dietary, digestive, and/or environmental origin
2. To neutralize existing toxins in the body
3. To excrete accumulated toxins in as nontoxic a manner as possible
4. To resolve infections and to minimize the risk for new infections
5. To supplement optimally
6. To address hormone imbalances, typically deficiencies

Statistically speaking, dental infections and toxins produced by those infections are the biggest factors in the causation and worsening of chronic degenerative disease. These sources of oral infection and toxicity can be itemized as follows:

1. Root canal-treated teeth (always chronically infected)
2. Other chronically infected teeth (often asymptomatic)
3. Chronic periodontitis (gum inflammation and infection)
4. Cavitational gangrene, at the sites of old extractions
5. Chronically infected tonsils, secondary to the chronic drainage of infected teeth
6. Infected dental implants
7. Toxic metals, like mercury and nickel (not necessarily associated with infection)

Chronically Infected Teeth and Gums

The root canal-treated tooth, due to the nature of the procedure, is always a site of chronic infection for as long as it remains in the mouth. Drs. Hal Huggins and Boyd Haley, in collaboration with dentists across the country, found that 100% of over 5,000 consecutive extracted root canal-treated teeth had very potent pathogen-related toxins, both endotoxins and exotoxins. Teeth extracted for orthodontic purposes that had not received root canal procedures were free

of these toxins. In root canal-treated teeth that were already "considered" to be infected, fungi, viruses, and over 460 different types of bacteria have been identified (Siqueira and Rocas, 2009).

Realizing that all root canal-treated teeth are infected and not just those considered to be endodontic technical "failures," the dental literature provides clear evidence of the always toxic nature of these teeth as well. Three different studies found endotoxins in 100% of such teeth tested (Rocas et al., 2011; Martinho et al., 2011; Gomes et al., 2012).

The reasons that root canal-treated teeth are always infected, toxic, and important players in so many different chronic degenerative diseases are quite straightforward. The procedure itself aims to scrape and rout out as much of the life-giving pulp inside the tooth as possible. This removes the blood supply, connective tissue, and nerves, all of which supply the very matrix that the immune system cells need to gain access to pathogens that need to be eliminated. Also, a normal tooth has a natural fluid flow from the inside (pulp) of the tooth outwards. After the pulp has been removed, this fluid flow reverses, and the many potential pathogens in the oral cavity are able to gain easy and continuous entry into the treated tooth. Nevertheless, if the pain in the tooth is eliminated by the procedure, which should be anticipated when all of the innervation is removed when the pulp is evacuated, the procedure is considered to be a success. Of note, a technically very successful root canal procedure can certainly "debulk" the amount of infection in the root canal space and surrounding the root tips. When this occurs, and the root canal space is technically well-sealed after being filled, the root canal-treated tooth does present less of an infectious and toxic insult to the body than if the procedure was performed with less expertise.

After the root canal procedure has been performed, the treated tooth could not be better suited to deliver its infectious and toxic contents throughout the body. Although the pulp was evacuated, the root tips still are "naturally" connected to the venous and lymphatic drainage systems in the jawbone. Every time chewing takes place, these toxic reservoirs can readily be disseminated throughout the body. And while no part of the body can completely avoid the regular delivery of these toxic payloads, they are especially prone to go via the lymphatics into the chest (breasts), neck and head. The venous drainage ends up impacting especially severely the coronary and carotid arteries, which are the first vessels of high internal pressure to be encountered, allowing an effective "embedding" of the oral pathogens and their toxins into the endothelium and arterial walls, allowing the process of atherosclerosis to begin.

All root canal-treated teeth are infected and toxic, but they are not all of equal negative impact on the health of the patients. Factors that determine the degree of negative impact on health include the following:

1. The unique pathogen flora, which can include bacteria, viruses, fungi, and protozoa
2. Whether the treated tooth is a chewing tooth (molar) or a small biting tooth (incisor)
3. The extent and degree of containment of cavitational osteonecrosis in the bone at the root tips
4. Genetic predispositions to different diseases
5. How long the root canal-treated tooth has been present
6. The quality of nutrition, digestion, and supplementation in the patient
7. Low hormone levels, especially thyroid, which greatly impacts whether a focal infection can disseminate and seed elsewhere
8. Age and general health of the patient, including the health of the bone in the jaw
9. The expertise with which the root canal procedure was performed, impacting the bulk of apical infection and how well the root filling seals the pulp space

The X-ray appearance of a root canal-treated tooth very often shows radiolucencies around one or more of the root tips. This X-ray appearance is known as chronic apical periodontitis (CAP), and it means infection is always present. When present around teeth that have not been root canal-treated, it always means the pulp of the tooth has become necrotic and chronically infected, continually

sustaining the infected pockets surrounding the root tips. Root canal-treated teeth, while always very toxic, are typically less toxic than untreated teeth with CAP. When this X-ray picture is encountered, even on a tooth that is asymptomatic and has not received a root canal procedure, proper extraction of that tooth is the only way to optimally support the health of the rest of the body and to eliminate the chances of metastatic spread of the focal infection.

Traditional dental X-ray examinations have long been missing a great deal of dental pathology now known to be directly causing or clearly linked to a great deal of heart disease, cancer, and other diseases of hitherto "unknown" etiology. Routine X-rays taken on root canal-treated teeth, depending on the quality of the X-ray and the expertise of the interpreter, show the radiolucencies of CAP between 40 and 70% of the time (Weiger et al., 1997; Saunders and Saunders, 1998; De Moor et al., 2000; Gunduz et al., 2011). However, a new 3D digital X-ray technology is finding CAP pathology much more often. In a study looking at examinations of 46 root canal-treated teeth, CAP was seen on 70% of the regular, 2D X-rays. The 3D X-rays of the same 46 root canal-treated teeth showed CAP 91% of the time (Lofthag-Hansen et al., 2007).

Chronic Dental Infections Cause Coronary Heart Disease (CHD)

One study examined the association of CAP teeth, with and without root canal treatments, and the degree of atherosclerotic burden in the aorta, as quantified by a calcium scoring method. The results showed that untreated CAP teeth, which are often asymptomatic and discovered only because of X-ray examination, are correlated positively with the degree of atherosclerosis in the patients studied. Those CAP teeth that received root canal treatments did not show this correlation. The practical point to take from this is that even though root canal-treated teeth have been shown to directly cause heart attacks (discussed below), the asymptomatic CAP tooth that has not received the root canal procedure is clinically more toxic with a greater negative clinical impact than those endodontically-treated teeth (Petersen et al., 2014). So, if the root canal-treated tooth has been shown to cause heart disease, then it is clear that the asymptomatic CAP tooth can be expected to cause it as well.

Cardiology has long accepted that chronic inflammation in the coronary artery is the primary cause of atherosclerosis. It is even acknowledged that bacterial and viral infection of vascular cells might play a prominent role in the development of this condition (Rosenfeld, 2013). Periodontal disease (gum infection) has long been associated with CHD, and debate continues as to whether it is an independent risk factor for CHD (Humphrey et al., 2008; Dorn et al., 2010; Ameet et al., 2013; Kodovazenitis et al., 2014). Regular warm water irrigation (e.g., Waterpik) with a small amount of hydrogen peroxide added can keep the gums in great shape and drastically limit the access of many oral pathogens to eventually reaching and infecting the root tips, a circumstance that could result in the highly toxic CAP tooth.

The question that cardiology seems not to ask is what causes the chronic inflammation? Inflammation only occurs where there is a severe antioxidant depletion, especially of vitamin C. The only consistent cause of chronic inflammation is when there is a continuous presence/exposure to infections and/or toxins (both sources of increased oxidative stress). As it turns out, the evidence for oral seeding of pathogens in the coronary arteries is so overwhelming it is a wonder that all cardiologists are not making a dental examination a routine part of the workups in their patients. In a study on carotid plaque specimens obtained during endarterectomy, 80% of the specimens had polymerase chain reaction (PCR) evidence of oral pathogens, even though the testing only looked for a limited number of specific pathogens (Haraszthy et al., 2000). A similar result was obtained in the examination of coronary artery plaque specimens obtained during bypass surgery (Mahendra et al., 2010). Finally, in a study that looked at atherectomy specimens from coronary arteries in 38 patients with coronary atherosclerosis, bacterial DNA was

found in 100% of these specimens, although no such DNA was found in control specimens. Over 50 different species of bacteria were found, and most atheroma specimens individually had an average of 12 different bacterial species identified (Ott et al., 2006). Nevertheless, the authors of this study decided that it could not be reasonably concluded that the bacteria were the causes of the atherosclerosis.

While it does not seem to be a huge leap to think that the consistent appearance of oral pathogens in atheroma specimens is directly fueling the chronic inflammation acknowledged to be the reason for the development of atherosclerosis, this certainly has not yet occurred. Very, very few cardiologists even ask a patient about the presence of root canal-treated teeth, much less pursue a thorough dental evaluation as an integral part of the cardiac workup.

A study published in 2013, if properly assimilated into the cardiological mindset, should change this chronic omission in the standard cardiac workup. A group in Finland analyzed the culprit blood clots aspirated from the occluded coronary arteries causing acute myocardial infarctions. In 101 such patients, PCR testing showed the presence of oral pathogens at a concentration 16-fold greater than in the surrounding arterial blood. Pathogens typical for root canal infection were seen in 78% of these patients, and pathogens typical for periodontal origin were found in 35% (Pessi et al., 2013). The enormously high concentration of oral pathogen DNA finally makes it clear that the pathogens coming from the mouth are causing the acute blood clots responsible for the heart attacks. It strains all reasonable logic to think that a sterile blood clot suddenly formed inside the coronary artery and then a huge concentration of oral pathogens somehow colonized the clot after the fact. This study, then, finally showed that root canal-treated teeth and chronic periodontitis caused heart attacks and were not just linked or non-specifically associated with them. Of note, another study showed that root canal-treated teeth with clear radiolucent lesions of CAP were associated with the even more rapid development of coronary artery disease compared to root canal-treated teeth free of these X-ray abnormalities (Caplan et al., 2006). Two other studies reported similar findings (Pasqualini et al., 2012; Willershausen et al., 2014). This is completely consistent with the finding noted above that CAP teeth resulted in a greater atherosclerotic burden while the root canal-treated teeth did not have the same measurable impact in that study.

In a large statistical study, it was shown that individuals who self-reported having received root canal procedures were more likely to have CHD than individuals who reported never having received a root canal procedure. It should be noted that there was no analysis of whether the root canal procedures were successful by endodontic standards or not. It only analyzed whether having had the procedure performed was associated with a greater risk of coronary atherosclerosis (Caplan et al., 2009). Based on other studies cited above, it would seem logical that if such individuals who had root canals were sorted into groups with and without the X-ray appearance of CAP, the incidence of heart disease would be even higher when CAP is present.

The dissemination of oral pathogens into the largest arteries (coronaries, carotids, aorta) was given even further support by another study. A majority of ruptured and unruptured intracranial aneurysms had PCR evidence of oral pathogens a significant majority of the time (Pyysalo et al., 2013; Pyysalo et al., 2016). Another study looked at the pericardial fluid in CHD patients at autopsy. PCR testing for oral-pathogen specific DNA was found a majority of the time in these fluid specimens, and the worse the CHD was, the greater the total amount of DNA was present (Louhelainen et al., 2014).

Chronic Dental Infections and Cancer

In addition to the cause-and-effect relationship now documented between the blood clots causing heart attacks and the oral pathogens of root canal-treated teeth and chronic gum disease, a strong link also exists between chronically infected teeth and

cancer. In the 1950s, when root canal procedures were decidedly uncommon relative to today, Josef Issels, MD, found that 98% of his adult advanced cancer patients had "between two and ten dead teeth." In addition to the fact that Dr. Issels regarded the root canal-treated tooth as a dead tooth, the sheer number of infected teeth of any variety that he uncovered when diagnostic X-rays were well below the resolution of today's technology is impressive. He would routinely extract these teeth, as well as perform tonsillectomies, before he applied his treatment protocol, which was very effective (Issels, 1999). He frequently found that the tonsils that even appeared normal by examination in these patients to be abscessed and chronically infected upon removal.

While Dr. Issels treated all varieties of advanced cancer, many cases were of the neck and chest. Not surprisingly, the draining lymphatics of the jawbone holding the infected teeth make it even more likely for toxin-induced antioxidant depletion (increased oxidative stress) to occur in these same areas receiving the lion's share of this toxin- and pathogen-laden lymphatic drainage. Although it does not yet have the same cause-and-effect proof of root canal-treated teeth and heart attacks, a strong case can be made for root canal-treated teeth and other infected teeth being the primary cause for the vast majority of cases of breast cancer. These relationships need to be carefully scrutinized, since about 25 million root canal procedures are done annually, and the numbers continue to grow. And since the asymptomatic CAP tooth appears to be even more toxic than a technically well-performed root canal-treated tooth, 3D digital X-ray examination of the teeth simply must become part of the routine evaluation of all patients with chronic disease, and especially of those with heart disease and cancer. A clinical evaluation can never suffice. No physician can diagnose diabetes without measuring the blood sugar. The same goes for diagnosing asymptomatic CAP without a quality X-ray examination. If 3D is not available, the best X-ray technology available should still be utilized to best evaluate the patient.

Another medical condition that should immediately lead to a 3D X-ray examination of the teeth is when the patient has any chronic or unresolving sinusitis, or even chronic rhinitis. It is not uncommon for the radiolucencies of CAP, in teeth with or without root canal treatments, to either directly contact the floor of one of the maxillary sinuses, or even to break through the bony sinus floor and communicate directly with the sinus cavity, resulting in chronic inflammation and infection (Kulacz et al., 2004).

Cavitations

The cavitation, or cavitational osteonecrosis, is another source of dental toxicity that is extremely common, although it remains little appreciated by mainstream dentistry. A cavitation is the residual hole resulting from the incomplete healing of the jawbone after the tooth is extracted. This incomplete healing occurs largely because the "routine" dental extraction makes no attempt to remove the periodontal ligament, a dense encasement of connective tissue that serves to both anchor the tooth in the jawbone as well as to serve as a natural "shock absorber" to minimize any potential trauma to the tooth during chewing. It would appear that when the tooth is removed and the ligament is left behind, which is almost always the case, the surrounding bone cells have no physiological awareness that the tooth is gone, and the natural stimulus for those cells to start multiplying never occurs. Also, the continued presence of the ligament physically prevents any significant ingrowth of new bone cells. At the top of the extraction site, where the ligament ends, bone cells do start multiplying, resulting in a variably thick cap of bone over the extraction space. The degree to which cavitations develop after the routine extraction can vary greatly, since pieces of the periodontal ligament can be inadvertently removed with the tooth, and some filling in of the extraction site with bone can occur. Even though cavitations can be proven to be present in the vast majority of adults who have had wisdom teeth removal even

decades earlier, most dentists either do not know they exist or simply refuse to believe that they exist (Levy and Huggins, 1996).

Cavitation contents are consistently highly toxic. Upon surgical exploration, all cavitations have a necrotic content that is indistinguishable from wet gangrene. The same variety of toxins and pathogens are found in the cavitation as are found in the apex of the root canal-treated tooth or in the radiolucent spaces seen on X-ray in any teeth having CAP. The cavitation "infection," however, is generally less acute in nature, with a pathogen population that is more sparse than in other dental infections, and with only a minimal presence of immune cells. The clinical consequences of cavitations are also highly variable, ranging from no discernible impact to being the primary reason for almost any given chronic degenerative disease. Important factors in determining the clinical impact of one or more cavitations include the following:

1. Size, with more necrotic contents in larger cavitations
2. Socket site, with molar sites generally more impactful
3. Presence of adjacent cavitations, root canal-treated teeth, or other teeth with CAP, which can result in an ameba-like spread of the cavitational process
4. Spreading cavitations can cause new infection and CAP of previously healthy teeth; root canal-treated teeth can also cause CAP in adjacent teeth and result in more cavitational osteonecrosis
5. Underlying health of the patient relates directly to how all of the factors above will permit existing cavitations to spread throughout the jawbone; older edentulous patients can have extended, linear "channel" cavitations
6. How much chewing pressure will take place over the cavitation sites; typically minimal since the tooth is missing
7. Lack of a natural venous/lymphatic delivery system for the pathogens and toxins in smaller cavitations; the larger, spreading cavitations are much more effective in disseminating their contents throughout the body
8. Potential involvement with, and dissemination via, the nerve pathways in the largest of cavitations, as is seen in Neuralgia-Inducing Cavitational Necrosis (NICO); present relatively infrequently with cavitational disease, and the pain syndromes can be severe and quite varied in presentation (Gandhi et al., 2012)

As mainstream dentistry still does not "believe" in the existence of cavitations, much less appreciate their negative clinical impact, the dental literature has nevertheless given strong, although inadvertent, support to their contribution to chronic disease. The presence of fewer teeth, a state that is virtually always accompanied by more cavitational necrosis, has been linked to increased all-cause mortality, meaning an increased risk of death from all diseases. Other researchers have established it as being more specifically related to an increased risk of death from heart disease (Elter et al., 2004; Holmlund et al., 2010; Liljestrand et al., 2015).

While cavitations can still occur even when an extraction is done correctly with the complete removal of the periodontal ligament, attention to ligament removal can typically make any residual cavitation smaller, better-contained, and less likely to cause long-term health consequences. Allowing the extraction site to fill with blood and clot normally, and the use of platelet-rich plasma, also help to supply the important matrix needed for new bone cells to grow into and eventually fill the extraction site (Albanese et al., 2013). Periodic ozone applications in the extraction site (or possibly the developing site of cavitation) appear to be strong contributors to the growth of new bone. Multiple studies now show that ozone applications can stimulate and augment bone growth in osteonecrotic areas of the jawbone (Kaptan et al., 2013; Brozoski et al., 2014). Animal studies also demonstrate the effectiveness of ozone in promoting bone healing, including post-tooth extraction (Erdemci et al., 2014; Alan et al., 2015).

Dental Implants

A dental implant involves the insertion of a dental material (post or anchor) at the site of a missing tooth. This post allows the subsequent attachment of a prosthetic tooth

or even to anchor a bridge. Unfortunately, the implant procedure is usually initiated immediately or very shortly after the tooth extraction takes place. This means that when the extraction was done in the "typical" fashion without the proper removal of the periodontal ligament, the implant is being initiated in an area of a potentially developing cavitation, and the implant procedure itself only serves to seed whatever pathogens and toxins present deeper into the bone.

In any given patient the toxic/infectious impact of a dental implant can range from inconsequential to massive, for the reasons noted above. Certainly, dental implants can be very satisfactory solutions to missing teeth for many patients when done and maintained correctly. When the procedure takes place in solid, healthy bone without any developing osteonecrosis, a dental implant can be stable, strong, and of no toxic consequence. However, a period of at least three months in the lower jaw and six months in the upper jaw must be allowed to pass after tooth extraction to allow sufficient bone growth into the extraction site. Autoimmune reactions due to the foreign material being directly implanted into bone can sometimes occur, although they still do not have to be of profound negative impact on the general health as long as chronic infection is avoided. Ozone administration appears to be an effective tool in keeping any evolving peri-implantitis in check, helping to avoid an eventual scenario of CAP, which would mandate implant removal (Hauser-Gerspach et al., 2012).

Another factor that lessens the toxic/infectious impact of a poorly-done implant relative to any other infected tooth is the lack of the natural venous and lymphatic drainage as is present with any natural tooth that becomes infected, like the root canal-treated tooth or the tooth with CAP. This lack of a naturally built-in delivery system for the pathogens and toxins also further lessens the clinical impact of any relatively small amount of infection or inflammation that might exist around the properly-done dental implant.

Extremely important in maintaining the healthy status of a properly-done dental implant relates to meticulous and regular gum care. As the gum (gingiva) area of contact around the implant prosthesis is the primary barrier that prevents pathogens from reaching the prosthesis-bone interface over time, it is essential that even minimal amounts of inflammation and early infection/colonization are not allowed to take hold. Regular water irrigation (e.g., Waterpik) with small amounts of hydrogen peroxide added is excellent in keeping the gums and the margins of contact with implants (and teeth) in healthy shape. Quality supplementation is also important since inflammation has difficulty taking hold when higher gum tissue levels and circulating levels of vitamin C and other antioxidants are present.

Focal Infection and Thyroid Status

A great deal of evidence has been presented that underscores the clear role that dental pathogens play in promoting chronic degenerative diseases, especially CHD and atherosclerosis. Certainly, before any circulating pathogens can cause great harm, they need to effectively seed a remote site in the body, like the coronary arteries, and begin to proliferate. One of the greatest facilitators of a focal infection taking hold anywhere in the body is a depressed thyroid status in the body. This finding was revealed in a dramatic fashion by the work of Broda Barnes, MD, who reported on 1,569 hypothyroid patients that he treated with desiccated thyroid, many over a 20-year period. Of 844 women, none had heart attacks. Only four men of the remaining patients had heart attacks during this period of time, and Dr. Barnes noted in retrospect that the thyroid dosage might have been too low for these individuals. The large Framingham study conducted by the National Heart Institute followed 5,000 men and women over an extended period to help determine the incidence of coronary heart disease. Examining comparable groups by age and sex revealed that Dr. Barnes should have seen 22 heart attacks among his 844 women, and 50 heart attacks among the men in his study. Dr. Barnes even

noted that none of his patients were asked to stop smoking. 62% of his men smoked, and a significant percent of the women smoked as well. Finally, Dr. Barnes noted that another 30 of his patients who decided to stop thyroid therapy subsequently had heart attacks (Barnes & Galton, 1976; Starr, 2009).

While a greater amount of precision in data collection would have been desirable, there appears to be little doubt that taking enough dessicated thyroid administration in hypothyroid patients to normalize thyroid status throughout the body has a strong protective effect against having a heart attack. Statistically, a substantial number of Dr. Barnes' patients would have had root canal-treated teeth, asymptomatic CAP, and chronically infected gums (especially since many were smokers). Yet it would appear that a normal thyroid status in this patient group was able to effectively prevent nearly all focal infection from colonizing sufficiently in the coronary arteries to initiate and sustain the development of coronary atherosclerosis. While there is no proof yet in support of such a supposition, it is also compelling to speculate whether normalizing thyroid function would similarly protect the breasts and other parts of the body from the carcinogenic effect of dental pathogens and toxins.

Very many adults, likely a majority, are at least mildly hypothyroid. However, standard thyroid testing is not very useful in detecting decreased thyroid function in such individuals. Standard testing is really only consistently useful in detecting hyperthyroidism or severe hypothyroidism. Much of the reason for this is that most mildly hypothyroid patients have intracellular rather than glandular hypothyroidism. It remains largely unappreciated that roughly 80% of the T4 produced by the thyroid gland is converted to T3, the active form of thyroid hormone, outside of the thyroid gland. Instead, the circulating T4 is taken up in the cells throughout the body and converted enzymatically inside those cells into active T3 (Pilo et al., 1990; Escobar-Morreale et al., 1995; Hoermann et al., 2013). As the body encounters more toxins and becomes more diseased over time, the T4 to T3 enzymatic conversion inside cells becomes increasingly compromised. The thyroid gland itself can be functioning quite well, yet the body can end up being significantly hypothyroid, and it will not be reflected in standard thyroid testing.

While the physician looking to accurately diagnose a patient's thyroid status needs to monitor body temperature and the whole range of signs and symptoms that occur with hypothyroidism, it is also important to routinely test for reverse T3. As cells become more impaired in their ability to convert T4 to T3, reverse T3 levels tend to increase. Reverse T3 does not have thyroid hormone function, and it becomes a "blank key" that will bind the receptors normally bound by active T3, diminishing overall thyroid hormone effect clinically. As T3 levels increase and other chronic diseases are effectively treated, reverse T3 levels drop and thyroid function can improve or normalize. The current thinking is that a ratio of free T3 to reverse T3 should be somewhere between 18/1 to 21/1. A higher ratio, as long as the patient is not clinically hyperthyroid, is acceptable, while a lower ratio indicates the need for dessicated thyroid and/or T3 administration.

A General Protocol for Treating Chronic Degenerative Disease

The primary goals for a chronic degenerative disease treatment protocol should include:

1.Minimizing new toxin exposure
2. Eradicating acute and chronic infections
3. Eliminating accumulated toxins when impairing clinical recovery
4. Restoring hormone levels documented to be below normal (estrogen, testosterone, thyroid)
5. Optimizing antioxidant and nutrient levels, especially vitamin C
6. Selectively and appropriately utilizing prescription medicines

Minimizing new toxin exposure is profoundly important in optimizing clinical recovery from any disease process. All of the sources of oral infection and toxicity need to be properly addressed. Calcium, copper, and iron supplementation should be carefully

avoided. A true iron deficiency anemia does warrant the supplementation of iron, but only the rarest of circumstances justifies the supplementation of calcium and copper.

While organic foods are optimal, optimal digestion is of paramount importance. Poor foods digested perfectly produce less toxicity than optimal foods digested poorly. Some of the most important factors in digesting optimally include combining foods properly, prolonged chewing, minimal liquids with meals, supplemental digestive enzymes, and minimizing the size of a given meal, especially regarding the quantity of meat consumed at a time.

Whenever infections are obvious, all attempts should be made to eradicate them. However, occult infections are much more problematic. When all infected teeth and gums have been addressed and clinical problems persist, consideration should be given to tonsillectomy as well. As discussed earlier, chronic dental infections often turn the tonsils into focal sites of chronic infection as well. It has to be a clinical determination as to whether a tonsillectomy is warranted in trying to restore the health of a patient.

Toxin elimination is also important when clinical recovery is not proceeding as readily as desired or expected. Many different forms of chelation are used, and different approaches can produce positive results. However, detoxification always results in some degree of retoxification, and potent chelating agents, such as DMPS, must have high-dose antioxidant protection, preferably intravenous vitamin C, to protect against the negative effects of the flood of toxins often released by this agent. Multiple nutrient agents help excrete toxins well, including alpha lipoic acid, inositol hexaphosphate (IP6), and many others. Regular brisk sweating, as with a far infrared sauna, also mobilizes and eliminates a wide range of toxins.

As testosterone, estrogen, and thyroid hormone deficiencies literally affect all the cells of the body and increase all-cause mortality, they must be addressed in a complete treatment protocol. In general, certain principles should be followed in hormone supplementation. Hormone therapy must be low dose, slow to increase dose size, and the target laboratory hormone levels should be no more than low to mid-range normal. Where appropriate, bioidentical hormone preparations are preferable.

Supplementation regimens take on many forms for many people. Most people face limitations due to what can be afforded and what the stomach can tolerate. Very many good supplements can be taken, but nearly all regimens should include the proper dosing of magnesium, vitamin C, vitamin K, vitamin D, and the B vitamins.

Prescription medicines should only be taken when the above measures do not have the complete clinical or laboratory response desired. One important example of a clear need for prescription medication most of the time is in dealing with high blood pressure, or hypertension. Elevated blood pressures must be well-controlled, and it can only rarely be done well without prescription anti-hypertensive medicines.

Conclusions

All chronic degenerative diseases are caused or worsened by chronic infections and the increased oxidative stress that they inflict throughout the body. Many significant diseases, particularly coronary heart disease, are primarily caused by dental infections and toxins. Many cancers, especially of the breast, also appear to be directly caused by these same sources of pathogens and toxins.

Aside from directly addressing the various sources of dental infections and toxins, the importance of the patient having normal thyroid function throughout the body cannot be overemphasized. Infections are supported in their ability to take hold enormously by even minimally depressed thyroid hormone function.

Finally, and most importantly, dentists and physicians simply must start working in a more coordinated fashion for their patients to have their best chances of dealing with their various diseases. All heart patients need a proper dental evaluation, and dentists with patients who have root canal-treated teeth should routinely encourage those individu-

als to have a cardiac evaluation. Full mouth 3D digital X-rays should be a routine part of the evaluation of all chronic disease patients, right along with the glucose, electrolytes, CBC, and biochemistry panel. Chronic apical periodontitis (CAP) is more toxic than the root canal-treated tooth, and it must be sought out and identified, since it is usually asymptomatic.

Competing Interests

The author declares that he has no competing interests.

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