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CERAMIC IMPLANTS: THE NEW CHAPTER IN IMPLANTOLOGY



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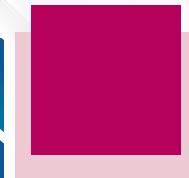
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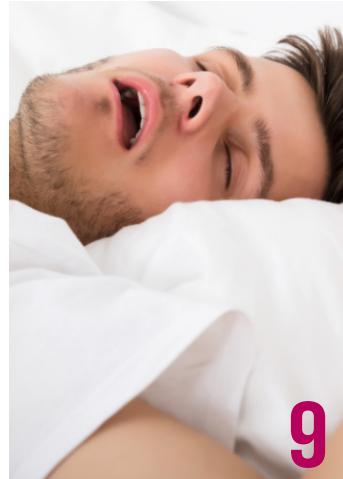


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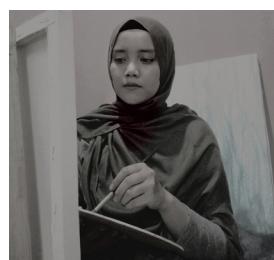


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EDITOR'S DESK



A NOTE FROM OUR GUEST EDITOR **DR. HUGH FLAX, DDS, AAACD, MICOI, DABAD**

"What Got You Here, Won't Get You There"

One of the world best success coaches, Dr. Marshall Goldsmith, is credited with the above quote in his book¹ of the same name. According to him, there are behaviors that stop you from achieving even more success. Unfortunately, plenty of leaders hold on to awful character traits and unhelpful behaviors. Some just don't want to grow and expand especially in our rapidly changing world.



Not to be a "Debbie downer". This even applies in our dental profession. The ongoing pandemic did not stop the expansion of knowledge and new techniques. With digital dentistry, as well as, newer technologies and materials, biting at our heals, many are fighting hard just to keep up.

Just as important, serving our patients health needs is swiftly advancing at a revolutionary pace. Vital to that growth, our own physical well being is being challenged. For that reason, we have created a SPECIAL ISSUE focused on the "other side" of DDHK -Healthcare- to bring our readers some of the "best and brightest" educators to expand your knowledge and give you access to insights and concepts to extend the lives of our patients and the dedicated dental professionals who serve them.

Here's what we have in store for you to expand your thinking and care:

- Eric Pulver will give you a deep understanding use of AI (Artificial Intelligence) will help support accurate comprehensive care in a fast-paced world, and a potential gamechanger not just in the future—but now.
- Christian Hahn demonstrates why zirconia implants are more biocompatible than traditional titanium ones.
- Katrina and Elizabeth Sanders speak eloquently on the dental and medical professions are in a position to synergize and help improve diagnosis rates and save many lives -----just by thinking "big picture" and not "shoulding" on ourselves and our patients.
- Jeff Horowitz, our expert on sleep disordered breathing, will show you how the dental profession is in a position to collaborate with our medical counterparts by adding new protocols to any office can be both disruptive, and at times cannibalize the strengths and services of successful practices.
- Peter Greenlaw, book author, will elaborate in detail about how nutrition is more critical than ever in slowing the aging process and fighting the expansion of toxins in our environment that ultimately can challenge our body's energy and survival.

I challenge each of you to deeply read this new edition more than once and share this with your teams and patients. Even better, explore, expand, and implement some (if not all) of these strategies. You and those around you will be grateful for your commitment.

To our and our patients' mutual success,

1. Goldsmith,M.; Reiter,M. What Got You Here Won't Get You There: How Successful People Become Even More Successful: Hachette Books; Revised ed. edition ;February 22, 2007.

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CHRISTIAN W. HAHN, DDS, AAACD

A BIOLOGICAL CASE FOR ZIRCONIA IMPLANTS

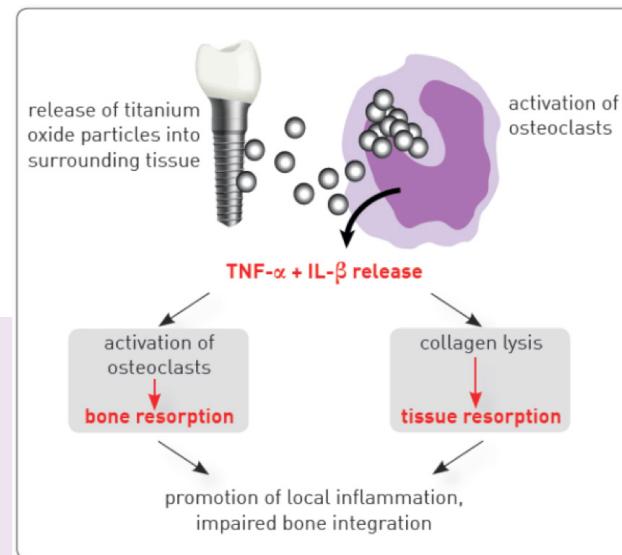
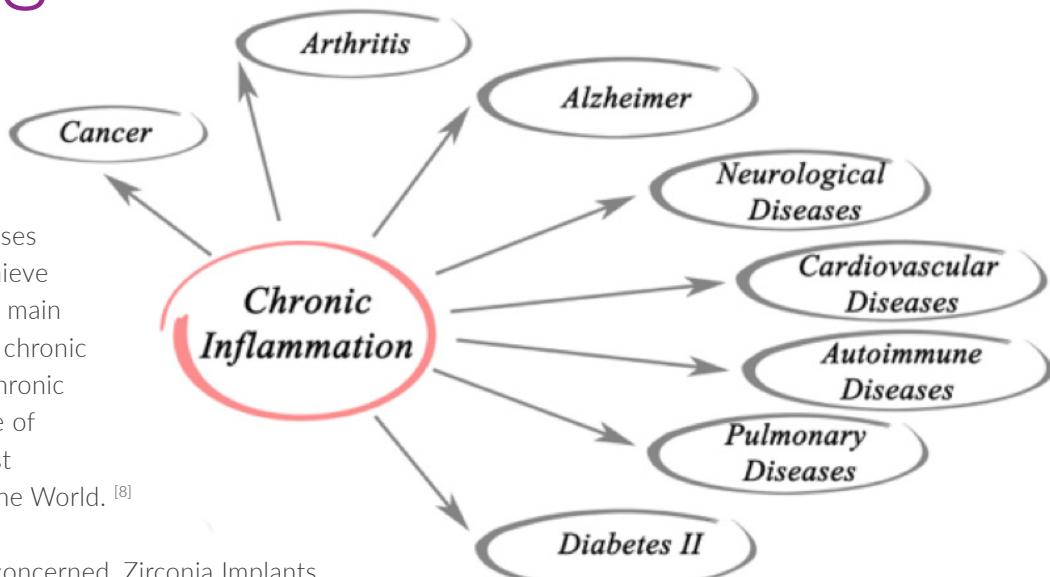
Biological Dentistry focuses on helping patients achieve optimal health, and the main way we do this is by reducing chronic inflammation in the mouth. Chronic inflammation is the root cause of nearly all disease and the most significant cause of death in the World.^[8]

As far as dental implants are concerned, Zirconia Implants do not increase inflammation in the mouth, Titanium Implants do. Let me elaborate.

For decades Titanium Implants were often not only the best, but also the only solution for tooth replacement. Success rates for Titanium Implants have been well documented, as have the rates of peri-mucositis and peri-implantitis, both forms of chronic inflammation. Peri-mucositis and peri-implantitis are both a result of Titanium alloy ion release (rusting, corrosion, etc.).^[1]

"In this new era of Biological Dentistry, the ultimate goal for practitioners is to reduce or eliminate chronic inflammation, not just restore form and function." - Dr. Hahn

Titanium ion release results from the well documented breakdown of Titanium alloys in the mouth^{[2][3]}. Zirconia implants do not break down, release metal ions, or undergo corrosion. They do not rust. This shedding of Titanium ions presents a significant and constant threat to the immune system through activation of osteoclasts



and up-regulated the expression of interleukin-6, interleukin-8, cyclooxygenase-2 and RANKL, resulting in chronic inflammation.^[7]

This beckons the ultimate question - should Titanium Implants be considered biocompatible at all?

Zirconia implants result in superior levels of tissue health without the release of inflammatory agents.



The only reason why Titanium Implants are biocompatible in the first place is that they are coated with a thin layer of TiO₂, a ceramic. The Titanium alloy in itself is not biocompatible. Once this singular layer of ceramic around the Titanium is removed, or damaged, Titanium ions are released. These Titanium ions then proceed to stimulate bone loss and continuous tissue inflammation.

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It is fairly easy to break down the ceramic coating of the Titanium Implant, releasing these destructive Titanium ions.

Causes of Titanium ion release [6]:

- Implant bed preparation
- Implant insertion
- Saliva
- Chemicals (fluoride)
- Mechanical abrasion (hygiene)

Conclusion

The literature supports the claim that Zirconia Implants are the best biological choice for the patient, as they do not create chronic inflammation. If our goal as healthcare providers is to improve the health of our patients, isn't it time we walked the talk and focused on using products, materials and procedures that reduce chronic inflammation?



JEFFREY W. HOROWITZ, DMD, FAGD, D-ABDSM, D-ASBA

TECHNOLOGIES TO IMPROVE RECOGNITION AND TREATMENT FOR SLEEP RELATED BREATHING DISORDERS



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It is no secret that the role of the general dental practitioner has expanded in recent years, with many offices now implementing protocols for the recognition and treatment of sleep related breathing disorders (SRBD's). In supporting statements, organizations such as the AADSM (American Academy of Dental Sleep Medicine)¹, the ADA², and the AGD³ have all recognized that dentists are in a unique position to observe some of the earliest signs of a sleep related breathing disorder. By varying estimates, Obstructive Sleep Apnea is a condition that could be affecting as many as 100 million Americans.⁴ Many would agree that our current medical system has failed this population with an estimated diagnosis rate of less than ten percent.⁵ With full appreciation of the implications of this health care crisis and the number of our own patients that are affected, we in the dental profession are in a position to help improve diagnosis rates in collaboration with our medical counterparts. But adding new protocols to any office can be both disruptive, and at times cannibalize the strengths and services of successful practices. To this point, it must be noted that modern technologies can make this process more streamlined, offering tools that educate our patients, improve recognition, and create more successful outcomes. In this article, several technologies will be

discussed as well as how they can be utilized within the scope of a general dental practice.

CBCT:

The first technology that must be discussed is Cone Beam C-T technology. In this author's opinion, CBCT is the single most under-utilized tool in modern dentistry that can offer

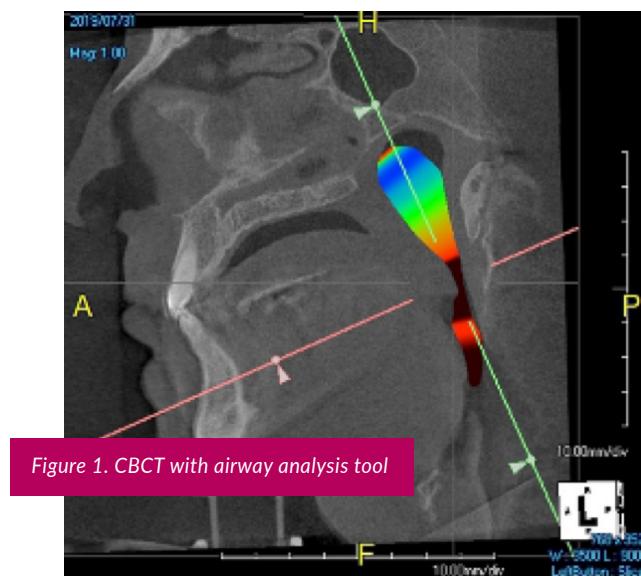


Figure 1. CBCT with airway analysis tool

the highest ROI to almost any practice. With the proper CBCT, a standard resolution scan can be taken with very reasonable radiation levels that can and will uncover concerns that were always there, but never seen in the past. In my practices, a CBCT full field-of-view image is taken on every new patient unless there has been a recent full field of view CBCT taken that can be reviewed. This allows for a comprehensive dialogue that includes the health of the teeth and jaws of course, but can be expanded into discussion on the health of the T.M..... joints, orthodontic concerns, and for the purposes of this article, the airway. For children, the tonsils and adenoids can be readily observed. It is well understood that adenopathy associated with these structures can negatively impact breathing causing poor sleep, poor behavior, poor school performance and poor growth and development.⁶ A poor naso-pharyngeal airway can also lead to improper tongue posturing and swallowing habits, creating complex orthodontic challenges.⁶ In adults, a simple measure of the minimum cross sectional area at the greatest point of constriction of the oro-pharyngeal airway can be a useful tool to identify patients at risk for SRBD's.⁷ Many of the current CBCT manufacturers have implemented airway analysis applications into their software which allow for easy recognition of potential risks for SRBD's.

Digital Intra-oral Scanning:

Digital intra-oral scanning is a technology that has evolved way beyond the simple restorative applications it was initially utilized for.

Current scanners can image and store full arches/bites in minutes, offering clinicians a permanent baseline record for diagnosis and bite analysis. If something is missed at the clinical exam, this information is available at the click of a button while a case is being treatment planned and can serve as a reminder that airway concerns may have impacted the malocclusion or arch-form noted. Additionally, should there be a need for treatment, the same scans can be re-purposed for fabrication of an oral appliance, requiring only a therapeutic positioning bite that can be captured in seconds. This technology creates an incredible time savings, as the lab has the information on the same day and can immediately begin fabrication of the chosen appliance.

Acoustic Reflection (Pharyngometry/Rhinometry):

Perhaps less-known throughout mainstream dentistry is a technology that measures nasal patency and oro-pharyngeal cross-sectional area in real time. Acoustic reflection, as the name suggests, uses sound waves to map the naso and



Figure 2. Acoustic reflection Pharyngometer/Rhinometer

oro-pharyngeal airways in real time and without ionizing radiation. While this can be an effective tool to screen patients for SRBD's, where this technology provides the greatest benefit is in helping to identify a therapeutic position for oral appliance therapy as well as identifying potential non-responders to oral appliance therapy.⁸ The technology is well known to the Ear Nose and Throat physician community who used it more commonly prior to the development of small endoscopic cameras to directly visualize the same structures being mapped by the sound waves. There are multiple advantages for dentists to utilize this technology when providing airway services. The first test, rhinometry allows for a fast and simple means of determining whether the patient has adequate nasal function or not. Poor nasal function is a leading cause of failure and adherence to both apnea.⁹ If nasal airway patency is seen as a problem with this test, a referral can be made to an E.N.T. physician and this creates an opportunity to build a strong cross referral network. At the very least the patient can be informed so as to help manage treatment expectations.

For the Oropharyngeal airway, a baseline (normal breathing), and simulated airway collapse using the Modified Muller Maneuver can be performed in real-time to approximate the extent and positioning of the airway collapse.¹⁰ With mandibular positioning jigs, the simulated collapse test can be repeated to see which position limits the extent of the collapse with the greatest efficacy. The oral appliance can then be constructed to this exact positioning. The advantage to this methodology is that the number of titration visits can be effectively reduced, reducing overhead costs for the practitioner. Finally, if there is no therapeutic position that changes the simulated collapse, the patient can be guided into other possible therapies that may prove more effective.

Home Sleep Testing and Remote Monitoring Devices:



Figure 3. Home sleep test devices

In-lab sleep testing has long proven to be a major barrier to diagnosis for those uncomfortable with the thought of that process. The reliability of home sleep testing has removed that barrier for many patients and has certainly increased the access to effective diagnosis. With the costs of these technologies decreasing, many dental offices have chosen to dispense home-sleep tests to increase diagnosis rates and to help monitor efficacy for those in treatment. It must be noted that this has not been without controversy and certain state dental boards have limited dentist's ability to do so.

For most states however, this has increased access to care and facilitated a simpler process for patients and dentists alike. All studies must still be read by a board-certified sleep physician for a medical diagnosis, but the availability of tele-health and protected data transfer have made this process quite efficient. For ongoing treatment monitoring, disposable remote home devices can now be purchased and dispensed to patients for as little as fifty dollars. These portable monitors can assess compliance and efficacy of treatment over the course of twelve nights and the data can be sent to one or more devices for the patient, dentist and referring physician to observe simultaneously over their smart devices. This creates the potential to perform at-home appliance titration while offering better patient understanding through participation in their treatment.

3-D Printing:

One of the concerns in the management of treating patients with severe obstructive sleep apnea has been the waiting period between obtaining the records and delivery of the oral appliance. While there are many temporary O.S.A. appliances available, limitations exist due to bulkiness, positioning, fit and retention. The ability to 3-D print a precision temporary appliance for a patient that is at high medical risk every night they are untreated is a service that should not be overlooked. Using the same digital scans and therapeutic bite, the design can be performed immediately with CAD software, or outsourced and returned to the office for 3-D printing within hours. Providing this service can be a true practice-builder, assuring patients and referring physicians of a practitioner's commitment to reducing medical risk.

While many other digital technologies exist to aid in the identification and treatment of SRBD's, the instruments mentioned in this article have all been utilized in this author's practice to create efficiencies that would not otherwise be possible. It should be noted that written screening tools can and should also be used by clinicians to create awareness for SRBD's, however if the conversation revolves around efficiencies, we must realize that many patients do not take kindly to additional paperwork, and that patients do not always report truthfully. Finally, adding technologies that improve diagnostic screening for disease and increase treatment efficacy make good business sense in practice. Patients will have more confidence as will the referring physicians, but it is the dentist who will receive the ultimate reward of having saved lives.

Figure 4. Digital intra-oral scanner and 3-D printer



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Meet the Author ->
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Dr. Jeff Horowitz completed his undergraduate studies at the University of Pittsburgh and earned his dental degree from the Medical University of South Carolina in Charleston. After completing a GPR at the Mountainside Hospital in Montclair, N.J., Dr. Horowitz founded the Carolina Center for Advanced Dentistry, a multi-disciplinary group practice with two locations in the Myrtle Beach, S.C. area. He is also the founder and clinical director for Advanced Sleep and TMJ Centers. His main interests include cosmetic smile rehabilitation, complex restorative cases, treatment of sleep disordered breathing, orthodontics and temporo-mandibular disorders.

Dr. Horowitz is a Fellow of the Academy of General Dentistry where he has served as a past-president for South Carolina and on the national Dental Education Council. Dr. Horowitz also serves as a mentor and past scientific advisor at the Kois Center in Seattle, a key opinion leader/lecturer for Catapult Education, a clinical instructor for Sleep Group Solutions, and global faculty for Align/Itero. His affiliations include the American Academy of Dental Sleep Medicine and the American Sleep and Breathing Academy holding dual-diplomate status, the American Academy of Cosmetic Dentistry, the American Orthodontic Society, the Piper Study Club, the American Academy of Craniofacial Pain and the Wellness Dentistry Network. Dr. Horowitz lectures internationally, has been published in dental literature, has contributed to many television news media reports and most recently, founded Dentists In The Know, an informational social media platform.

Angelo Cardarelli

PIEZOELECTRIC SURGERY OF IMPACTED TEETH

Preface by
Arun K. Garg

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Dubai- United Arab Emirates: The largest international annual scientific dental conference and exhibition in the world- the UAE International Dental Conference and Arab Dental Exhibition – AEEDC Dubai, will welcome back its visitors to its 25th edition next month in Dubai World Trade Center.

Last year, AEEDC Dubai was announced as “The largest international annual scientific dental conference and exhibition in the world”, which is a confirmation of its distinguished position in the dental community around the world. Throughout the years, AEEDC Dubai has successfully managed to become a destination for professionals and an anticipated global event, awaited by the biggest names from attendees, participants and exhibitors alike.

This year, and on its silver jubilee, the most anticipated dental gathering in the world- AEEDC Dubai welcomes back more than 55,000 visitors and participants from 155 countries, who will participate in 173 scientific sessions, take part in 6 workshops, and explore over 160 poster presentations on the latest topics in the field of dentistry, which will provide participants with rich information and will help in refining their skills and enriching their knowledge.

In addition, visitors will get the chance to explore over 4,000 international brands by 3,000 companies, who will showcase their latest innovations and state-of-the-art products in the exhibition occupying 37,300 square meters, and covering 7 halls in the Dubai World Trade Center. In addition, the exhibition will include 18 country pavilions, the largest being the USA pavilion, Italy pavilion, Germany pavilion, and South Korea pavilion, where top companies will showcase their latest and most advanced services and products.

Furthermore, the 25th edition of AEEDC Dubai is considered to be a special edition, especially as continuous education has proven its importance, and the empowerment of the medical field has shown its tremendous effect on nations and societies. Subsequently, 75 professors, doctors, surgeons, lecturers and field professionals will come together this year to present their latest studies, discuss cases, review effective solutions to existing issues, and conduct in-depth discussions and deliberations on ways to promote oral and dental health in patients across the world.

The scientific sessions will revolve around key topics in the field such as Aesthetics, Anesthesia, Dental Emergency, Dental Ergonomics, Dental Ethics, Dental Hygiene, Dental Laboratory Technology, Dental Practice Growth (Management and Marketing), Endodontics, Four/Six Handed Dentistry, Hypnodontics, Infection Control, Laser Dentistry, Microscopic Dentistry, Oral Implantology, Oral and Medical Photography, Oral Pathology and Oral Medicine, Pediatric Dentistry, Periodontology, Prosthodontics, Restorative Dentistry, Robotic in Dentistry, Dental and Oral Radiology, Digital Dentistry, and much more.

AEEDC Dubai is organized annually by INDEX Conferences and Exhibitions – a member of INDEX Holding and a recognized American Dental Association Continuing Education Recognition Program – CERP- provider. AEEDC Dubai is held in strategic partnership with the Federal Authority for Identity and Citizenship, scientific partnership with the Ministry of Health and Prevention, and destination partnership of Dubai Corporation for Tourism and Commerce Marketing - Dubai Business Events.

AEEDC Dubai also has the support of Dubai Health Authority, Global Scientific Dental Alliance, Arab Dental Federation, Executive Board of the Health Ministers Council for Gulf Cooperation Council States, Gulf Health Council, GCC Oral Health Committee, Riyadh Elm University, Arab Academy for Continuing Dental Education, Saudi Orthodontic Society, Saudi Dental Society, Saudi Prosthodontic Society, International Association of Dental Research- IADR, Greater New York Dental Meeting, Manitoba Dental Association, and is a partner event of the FDI World Dental Federation.

Interview with Peter Greenlaw – A Pioneer in Making the World Aware of Toxins Through his Discovery of The TDOS Syndrome

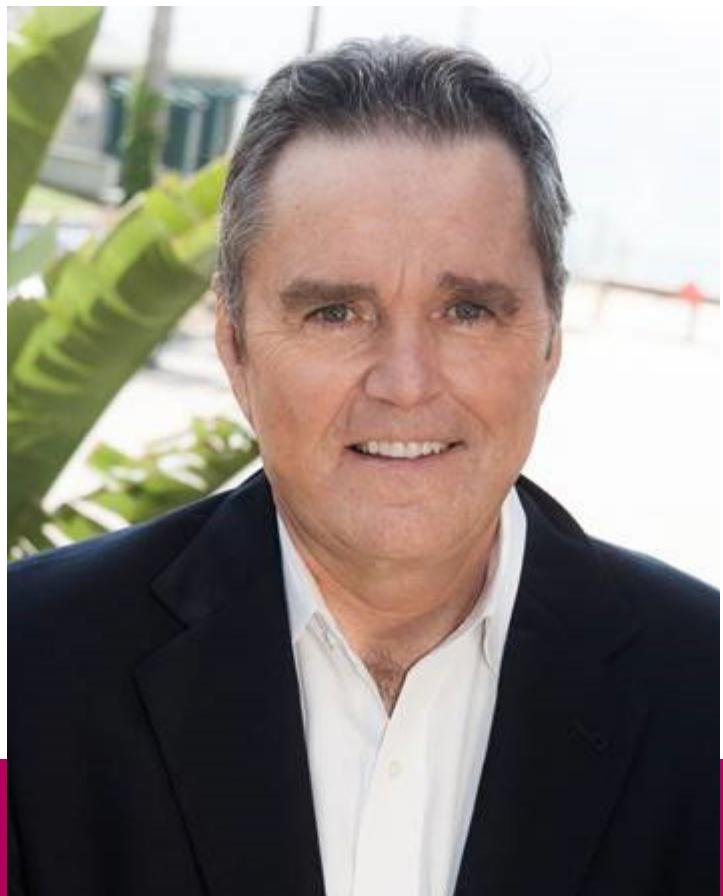
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Peter Greenlaw has been called the researcher of researchers.

Peter is also sharing his discoveries through his co-authored books *Why Diets are Failing Us*, *The TDOS Syndrome*, *TDOS Solutions*, and *Your Third Brain*.

He has also conducted more than 1,500 lectures around the world. He was also a featured speaker at the Autism One conference in May 2014 and 2015, and is a frequent speaker at the CEO Club of NYC.

Peter was a pioneer in making the world aware of toxins through his discovery of The TDOS Syndrome (Toxicity, Deficiency of nutrition, being overweight and Stress) and the role TDOS may play in causing us to have less energy, less sleep, more stress and a major reason we are gaining weight.



Peter is currently finishing up a new television series called The Greenlaw Report. The Greenlaw Report will feature some of the world's leading health scientists, medical doctors and researchers including, Marco Ruggiero M.D., Dr. John Gray PhD Author of Men are from Mars Women are from Venus, Dr. Bill Andrews PhD in population genetics and molecular biology.

Peter has been sharing his vision through multi-media sources as he has been a featured guest coast to coast. He was a guest on the Fox 5 Washington DC morning show, a guest of Greg Reitman on his Los Angeles-based show "On the Green Carpet", and he was featured on U-T San Diego TV hosted by Taylor Baldwin. Additionally, he was the featured-on ABC Windy City Live's New Year's Resolution show in January 2015 and has appeared on other prominent news programs including Bay City Sunday in San Francisco, Fox Los Angeles, Washington D.C. and Portland and Kansas City.



interview

Q What has motivated you to research, write, and lecture on toxicity and nutrition over the last 18 years?

A I walked in my doctor's office for my yearly physical results, and he said if I did not do something different that day, I might not be alive in 18 months. My cholesterol was 400, my heart attack risk was 85 out of 100, and I was 40 lbs. overweight. He put me on Lipitor, 1400 calorie diet, and 7 days a week of exercise. At the end of 8 weeks, I went back, and I had lost 8 lbs. which is what you lose on a diet at 1 lb. per week. The bad news is my cholesterol only came down 20 points and he said I cannot give you anymore medication. I was really discouraged. Later that same week, one of my former customers told me about the concept of detoxification. I said that I would try it as I had nothing to lose. I went on the protocol, and I lost 8 lbs. in 48 hours, 12 lbs. in 9 days, 20 lbs. in 18 days, and at the end of 8 weeks I was down 40 lbs. I had another follow up with my doctor and this time he was shocked that my cholesterol had dropped from 400 to 120 and I had lost 40 lbs. Another friend of mine, a gastroenterologist who had not seen me in 8 weeks, thought I was sick, as I had lost so much weight. When I told her what I was doing she said that is so ironic in that she was using this same detox in her practice with great results for her patients. She invited me to a dinner with 20 other doctors (I was the only non-M.D. at the dinner). The man who invented the detox was there to

address the questions from the doctors who were using this method. After I had told him my story, he said I know I have invented something that is going to change the world and I need someone like you to tell the world about it. I said, "I am flattered but I was a finance major in college and heck, I do not even know what a calorie is," and he said, "we will teach you." Now 18 years later, with over 10,000 hours of research working with some of the world's top oncologists, medical researchers, nutritional chemists, and geneticists, I am making the world aware of what we can do to maximize our quality of life potential. I say all the time I am not the expert, but I became an "expert on the experts". I have conducted over 1500 lectures all over the world. They call me the "researcher of the researchers". I have appeared 20 times on PBS, written four books all with M.D.'s, and am happy to say I am one of the leading advocates for making the world aware of how toxins in our world are really limiting our ability to live as healthy a life, as what is possible.

Q Share with us about TDOS Syndrome and TDOS Solutions?

A In working discovery that we are eating and drinking tons of chemicals, and as they enter the body, the body only has one defense. It has to store the toxins in our adipose fat and our visceral fat. My first book, "Why Diets are Failing Us" led me to get a registered trademark with the United States Patent Office for the TDOS Syndrome®. It stands for toxicity,

nutritional deficiency, overweight and stress. The point is that these four elements are bad enough on their own but when they combine, they wreck, even move havoc in the body. TDOS Syndrome contributes to weight gain, energy loss, stress, and many other factors. You see, our body has a natural detox mechanism. The problem is that our food is highly lacking in nutrition that the body cannot get enough support to get rid of toxins, so it has no choice but to store them in fat cells. The good news is that there is now a peer reviewed clinical study just completed by Dr. Paul Arciero, who is considered one of the top nutritional research scientists in the world. Dr. Arciero 100% showed in his study that what we had revealed in our book TDOS Protocol, had people losing a tremendous amount of weight quickly and safely, while at the same time increasing their lean muscle mass. This loss of muscle they have seen on every diet that had been studied in more than 35 years of research, which totally caught the researchers by surprise. The great news is this study validates scientifically everything that we had been taught by the world class experts that I have worked with. In the study they not only saw tremendous reductions in the adipose and the visceral fat the toxins were embedded in, they also saw the removal of toxins and the lowering of inflammation. Again, this is based on science not testimonials, feel good stories or white papers. They observed people losing as much weight in 4 days as those on diets for 6 to 8 weeks. The diets also showed



loss of water and muscle mass, while in studying the R2M protocol, there was no loss of water and they all increased lean muscle mass.

Q How can we obtain beneficial amounts of nutrition in our bodies that fruits and vegetables used to carry 200-1000 years ago? Is it even possible at this point?

A The two main things we are the most deficient in are minerals, of which we need about 70 and in the best organic food tested we are getting about 15. The good news is the fulfillment company we found that we use for the R2M protocol contains all 70 trace minerals. So, yes there is a way to enhance, not process, our food to make up for the "D" in TDOS and change to an "A" for Abundance.

Q What are some alternative options besides food people can take to give their body quality nutrition?

A The biggest things are ionic trace minerals, and it is exceedingly difficult to find a product that contains all 70. The sad part is people do not understand, if they are taking vitamins without minerals, all you are doing is paying for expensive urine.

Q Why does eating less not solve the problem?

A This is the old "calories in calories out" philosophy. This new study for Dr. Arciero totally debunks that as simply a false narrative. You see the problem with eating less is this. It is estimated that an orange from 30 years ago would require you to eat 6 to 8 oranges today to get the same nutrition. An apple would require 6 to 12 from 30 years ago. Cornell University did a study on spinach from 1953 and they said it has decreased since then by 4300%. You may say what about organic? In over 200 studies comparing organic to regular food, the organic was less laced with herbicides and pesticides but sadly there was extraordinarily little difference in nutrition. The entire concept of counting calories is now proven totally wrong because it does not consider what is in the calorie the nutrients which is the only thing the body cares about. Unfortunately, the SAD Diet (Standard American Diet) is just laced with sugar and simple carbs instead of nutrition because it is so much cheaper to produce.

Q What do we need to fuel the body to obtain cognitive and physical strength?

A As I have stated above at a minimum, we need the 70 trace ionic minerals every day. In addition, we need a great source of amino acids. The only way we can get amino acids are from proteins. And the more important point is, all proteins have 20 amino acids, but the key again is not the 20 you get but what percentage of the 20 that are used by our genes to make human proteins. All animal proteins have about an 85% absorption of protein. That is not what matters. What matters in the actual absorption of the amino acids in protein of only 30% called Net Nitrogen Utilization? There is a way to get 90% Net Nitrogen Utilization which was revealed in an analysis of all proteins from animals and vegetables, which is really the most important factor for our body to remake itself.

Q What advice do you have on intermittent fasting? Is this something you recommend? If so, how long of a fasting period is most beneficial?

A Harvard Medical School just came out and said that intermittent fasting, whether it is 16 hours fasting and 8 hours eating or a 24 hour fast in their recent analysis are simply diets. They only produced 1 lb. a week of weight loss. We have discovered this revolutionary new approach called intermittent nutritional fasting which relies on incredibly nutritionally dense food in very few calories. This is what was studied and proven to blow diets away in Dr. Arciero's study. Dr. Arciero saw people losing as much weight in a week as 2 months of dieting. The astonishing thing in the study was adipose and visceral fat went down and lean muscle increased. The diets they studied showed a loss of lean muscle mass in the same study.

Q How can people lose body fat and keep high energy levels?

A This is what they found in the study of intermittent nutritional fasting and R2M and protein pacing protocols. The study showed a significant reduction in adipose and visceral fat and no reductions in fat in the diets. The diets showed loss of water and reduction in lean muscle mass. The study said that dieting just does not work in the long run period.

Q Sleep plays a huge role in the body's ability to restore itself. What is a good nighttime protocol when it comes to eating, drinking, and exercise?

A The best possible thing to do before sleeping is to get a large amount of amino acids that the body needs in order to remake itself. That is now possible to get up to 90% absorption of amino acids.

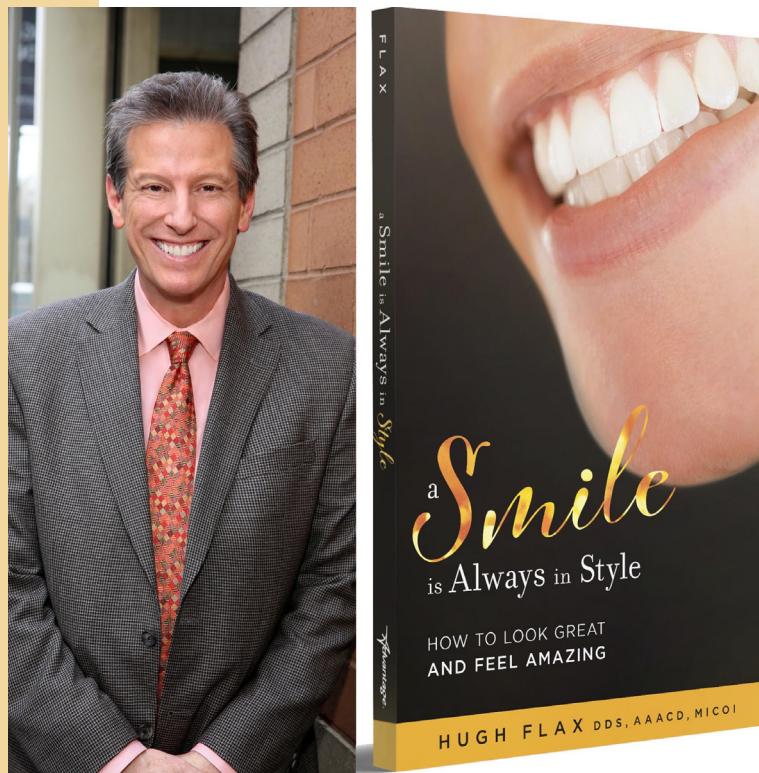
Q We get toxins from a variety of sources such as chemicals in the water we drink, pesticides and herbicides in the food we eat, toxins in the air we breathe, and many stress factors. None of which are going away anytime soon. What advice can you give to those skeptical of trying new technologies to live longer and healthier?

A There is no reason to just accept the fact that we are storing toxins in our adipose and visceral fat. Again, the study proved that it is possible to assist the body in removing even PCB's and Phthalates along with many other toxins. We tell people all the time the main reason to do intermittent nutritional fasting and R2M and protein pacing is not to lose weight but to detox the body. These protocols are really about maximizing our quality of life potential. Unlike diets this is a journey and not a destination.

If you would like additional information on how this could greatly increase your quality-of-life potential, we invite you to go to www.intermittentnutritionalfasting.com.

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The Oral-Systemic Link: The Next Epidemic



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We grew up from humble beginnings. Between the short weekend trips in the family minivan to the lake and our colorful tongues from eating otter pops in the summertime to munching on bologna sandwiches and playing in snow forts in the winter, Mom and Dad provided a simple but robust childhood. And just as much as our Midwest upbringing ignited our souls and thickened our accents, we both knew we needed to 'get out'.

A periodontal hygienist in Phoenix, Arizona and a foot and ankle surgeon in Puerto Rico, Mom and Dad proudly watched us grow in our education and build careers. As overt advocates for the oral-systemic link, we have written articles, published research and stood on stages, echoing a groundbreaking futuristic and united voice; and this was a voice that our empty-nested parents, from their Northern Wisconsin home, could brag about.

...but that is only where this story begins.

Mom and Dad understood that we were busy growing our clinical skills, furthering our education, traveling the world, and creating a conversation around the profound importance of treating our patients with due diligence standards within our respective professions. While we were occupied in saving the world one mouth and one foot at a time, Mom was experiencing esophageal and airway challenges.

After being shuffled through several primary care and specialty groups who were more concerned with ensuring they documented her Medicare identification number over treating her medical concerns, Mom's breathing capabilities continued to decline. On October 3, 2018, Mom was struggling to breathe, so she went to see her ear, nose and throat specialist. Her doctor performed a scope of her throat, told her everything looked alright, prescribed her an antibiotic, and asked her to return for a two-week follow up. Four hours later, after putting groceries away in the kitchen, Mom collapsed to the kitchen floor. When Dad discovered her, helpless on the ground, and began to perform CPR on



her. Mom was transported to a hospital in Northern Wisconsin where she was placed on life support after an airway obstruction diminished oxygen to her brain.

She was gently placed into a therapeutic hypothermia, and we waited, breathless, hoping she would respond. However, despite the strength and resilience we knew of her in our youth, she was not responsive, and Mom's doctors declared her brain dead. As heart-wrenching tears poured, we stood beside Dad as he signed consent to remove Mom from life support and signed her organs and tissues for donation.

Mom never made it to her two-week follow up appointment with her ENT specialist.

While we are still heartbroken to have lost Mom so suddenly and tragically, we are so grateful to know that Mom's organs have saved countless lives and her lungs are currently providing researchers in the University of Wisconsin Health System the opportunity to evaluate the response of SARS-CoV-2 to medicaments within a simulated respiratory tract. Mom was always passionate about being an organ donor and we know she would be grateful that her selfless gifts impacted so many lives.

...but the story does not end there.

In 2020, our widower father, now living by himself in Northern Wisconsin, had been delaying his visits with his primary care physician due to the COVID-19 pandemic. However, we had encouraged him to see a dermatologist for some concerning lesions on the back of his neck that received a differential diagnosis of basal cell carcinoma. Dad's doctor advised that this carcinoma was not concerning but his children, who wanted to keep their only living parent around a bit longer, convinced him to have the lesions removed for biopsy by his dermatologist. Three days after Dad's dermatology procedure follow-up appointment to have the sutures removed, he collapsed on the living room floor in the home he had shared with Mom.

Once again, we trudged through the horrifying yet seemingly recurring nightmare of learning that a parent was in the intensive care unit and on life support. As his prognosis worsened over the next 36 hours and as medical powers of attorney to Dad, we agreed to let the strongest man we have ever known go with dignity. Over a Zoom meeting on a Sunday evening, his children watched as Dad's nurses removed the tubing from his body and experienced the immeasurable pain of watching him slowly and powerfully take his last breath, nearly alone.

In December of 2020, Dad passed due to an undiagnosed sepsis from pneumonia acquired by walking the dog in the deep cold of a Wisconsin winter.

We used Mom's funeral as a template for Dad's, met with the priest who performed Mom's service to 'rinse and repeat' this nightmare and held our younger brother together as he stood in front of Dad's closet to hand-select the suit and tie Dad would rest in.

...however, our work didn't stop there.

As the conclusion of the year approached, we sat at Mom and Dad's seemingly empty kitchen table in Stevens Point, Wisconsin and worked tirelessly with cold and hollow hearts at our laptops to generate content to our respective communities about the oral-systemic link, building co-authored articles, presentation content and poster session proposals to continue the conversation around what we SHOULD be doing to protect our patients from illness. We did just what our parents taught us to do: we brushed ourselves off, ignored our bruised knees and kept pressing forward.

...and yet we sat there, hearts aching, as orphans of two parents whose providers, in our opinions, SHOULD have done something more.

How is it that Mom was seen the morning of her death by a doctor who told her everything in her airway was 'just fine'? How did Dad's doctor, three days earlier after removing sutures from his neck, miss the fact that he was becoming septic secondary to a deadly respiratory illness - even as we are amidst a global health crisis exacerbated by a respiratory disease? SHOULD these providers have done something more? If they did something more, is it possible that Mom and Dad could still be alive today? Could Mom and Dad be living their planned retirement on a golf course in Sedona, Arizona together? Could Dad have been able to walk each of his daughters down the aisle, or could Mom have met her future grandchildren? Could they have lived the life Mom wrote to Dad about on their wedding day; a letter we found months later when cleaning out their estate; a letter that, we imagine, a youthful and lovestruck Linda Weiler wrote dreaming of growing old with Dad, of being surrounded by their family and celebrating many years of a beautiful marriage and life together?

The sickening agony of sitting at our laptops, working through the pain of grieving Dad to honor our respective deadlines was intensified by recognizing that while nothing could be done to bring Mom or Dad back, we SHOULD be able to turn to our respective professions in which every day, someone's father or mother, brother or sister, husband or wife, child, cousin, grandparent or best friend seek our care for healing.

A social media thread coursed across the dental profession; this post posed a patient case, medical history, images,



and radiographs in which the provider was questioning if this patient is a candidate for non-surgical periodontal therapy. The comments rolled in: ‘this patient SHOULD get SRPs but insurance likely won’t cover it...’ or “you SHOULD refer this patient to their primary care physician, although I’m sure they won’t go anyways...” and yet the ending result, provoked by a mass majority of colleagues who knew best, was that the patient received a prophylaxis and a 6-month recare prescription.

...with the swift tap of a few trolling keyboard strokes, another patient received the bare minimum from a provider who knowingly SHOULD have done more.

Perhaps the true epidemic we should be concerned about; the issue that is making more people sick around the world than a virus; the challenges that are killing more people currently is actually the systemic ‘SHOULD’ of our collective professions.

We are plagued with comments from colleagues such as: “I know we SHOULD be taking blood pressure on every patient, but there just isn’t time for it!” or “I know we should be counseling surgical patients on diet and nutrition but nowadays, people won’t listen anyway” or “I know we SHOULD use that implant but their insurance just won’t cover it...”

What is it about that word: SHOULD? Is it possible that the word “SHOULD” implies that we know better, that we recognize we have a greater responsibility but that ultimately, we are “SHOULD-ing” our way out of treating our patients with the standard of care?

The snowflakes began to fall in Mom and Dad’s front lawn as winter rolled in. In learning the Sanders kids lost two parents within two years, our respective communities covered us with kindness and support. The gift baskets and floral arrangements arrived to Mom and Dad’s home as we grieved the pain of his loss. Handwritten cards, phone calls and text messages poured in, sharing condolences with the kind yet proverbial “let me know if you need anything.”

The winter never felt so cold, the Christmas holiday never felt so empty, but the beautiful outpouring of our respective professions reminded us that while we are orphaned, we are not alone.

So, to our esteemed colleagues: we are now calling in that “let me know if you need anything” favor. To clarify, the Sanders children have a request: stop “SHOULD-ing” all over yourselves and your patients. Let’s take a stand and start delivering to our patients.

Mom and Dad’s doctors created a “SHOULD-y” situation in which their regrets over their lack of complete care became apparent in the incessant phone calls to our family following their respective deaths.

Here’s the problem with “should”: it will not protect in a court of law, it will not help elevate standards as a clinician and it certainly will not serve the patients who trust you with their care.

Daily, we manage diseases that require a life-long commitment to attentive care. Dental decay found in the incipient stage requires consistent remineralization, and although decay may be treated with restorative procedures, we understand that routine examinations, improved diet, plaque control and continual remineralization therapy helps monitor and prevent the recurrence of a decay episode. Oral cancer identified in its earliest stages is easiest to treat; cancerous lesions identified in Stage III and IV have a far lower 5-year survival rate, and patients with suspicious lesions require consistent monitoring. Gingivitis is one of the single most influential risk factors in the exacerbation of oral inflammation and subsequent attachment loss, and periodontitis is actively recognized to be an irreversible disease process requiring consistent monitoring, maintenance and possible re-initiation of active therapy to stabilize. We know progressive gum disease has a positive correlation to cardiovascular disease including stroke or heart attack, respiratory diseases, diabetes, obesity, inflammatory conditions, viral diseases, hormonal imbalances, and cancers, yet we continue to diminish our potential impact as specialists.

Despite our best efforts, prevalence studies continue to identify the ways in which we are still unable to control the manifestations of this disease process. As research continues to unpack additional links of periodontal pathogens to the inflammatory processes associated with various comorbidities, as long as one patient continues to die every hour from oral cancer and until we can address the fact that dental caries is still the leading childhood chronic disease, we must not

Let's take
a stand and
start delivering
to our
patients.

only acknowledge but also actively step into our role in the healthcare community as specialists of the head and neck: the gateway to the rest of the body.

...and yet dentistry has become plagued with the concept of SHOULD-ing all over themselves.

As such, we are being called upon and as Mom and Dad would say: we have a lot of work to do and it begins with the opportunity we have to make an incredible impact and serve our patients through elevating our standards.

We SHOULDN'T assume that our tobacco-using patients do not want help. We SHOULDN'T accept that our patients don't care about their plaque control. We SHOULDN'T omit nutritional counseling simply because we don't have time and we SHOULDN'T withhold evidence-based treatment options simply because they are not a covered benefit under dental insurance plans.

We have the power to diagnose oral cancer, refer patients who may have undiagnosed diabetes or hypertension, counsel them on diet and nutrition, and certainly we have the proficiency to speculate if a patient has a respiratory illness.

We have the capability to save lives.

So, to our friends and family who cooked meals, sent flowers, donated to our efforts in organ and tissue donation, or called, we say thank you; to our esteemed colleagues whose thoughts and prayers have brought our family through this period of sorrow, we say thank you; and to those of you who asked us if there is anything you can do for us: yes!

PLEASE stop smearing SHOULD all over the gorgeous gift you have received from the patients who trust you, stop SHOULD-ing all over the responsibility you vowed to accept when you took the Hippocratic oath and most importantly: get your SHOULDs together... Mom and Dad are counting on it!

•••••

This article is dedicated to the loving memory of our parents, Robert A. Sanders, Jr. and Linda M. Sanders whose stories have inspired and driven so many professionals around the world to do better. We love you and miss you terribly. We hope your stories continue to change the world for the better and we hope we continue to make you proud.



This photograph was the last family photo we took together. It was taken 6 weeks before Mom passed, and 2 years before Dad passed. August 2018.

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CONTRIBUTOR SPOTLIGHT



AI: A Brief History

In 1950 Allen Turing asked the question "Can machines think?" ⁽¹⁾ he proposed an imitation game known as the Turing test as a way to demonstrate a machine's intelligence on a level equivalent to humans. ⁽¹⁾ His influence in this area remains significant. In 2018 the annual Turing award was received by Yoshua Bengio, Geoffrey Hinton and Yann LeCun for their work on Deep Neural Networks the magic behind Artificial Intelligence (AI) and Machine Learning (ML). ⁽²⁾

In 1956 a Pivotal workshop on Artificial Intelligence was organized by John McCarthy at Dartmouth College. He was attributed with coining the term Artificial Intelligence. ⁽³⁾ From this meeting the Field emerged, goals were outlined and John McCarthy (Stanford), Marvin Minsky (MIT), Allen Newell and Herbert Simon (Carnegie Mellon) emerged as leaders in AI. ⁽³⁾ This led to an AI spring filled with much optimism and hope, followed by lack of progress and an AI winter. This pattern continued until advancements in technology and compute power met pace with human creativity, imagination and the requirements for integration and implementation of AI/ML. Acceptance and integration of this transformative agent represents a complex mosaic and may prove as challenging as its creation. We are now faced with the opportunity to help nurture and guide this exciting technology safely and slowly into the rapidly changing world of Oral Healthcare. In time we may all wonder how we ever lived without the assistance and guidance of Artificial / Genuine intelligence.

In 1997, Deep Blue IBM's chess playing AI computer beat Garry Kasparov the worlds chess champion. AI was revealed publicly, on a large scale and appeared to have real promise. ⁽⁴⁾

AI: A GUIDE TO HELP US NAVIGATE THE NOISE OF DECISION MAKING IN ORAL HEALTH

L Eric Pulver, DDS, FRCD(C).

Founder Pulver Oral Surgery, Chief Dental Officer Denti.AI and Chief Innovation officer at Revere Partners

In 2005 Ray Kurzweil's book Singularity brought attention toward general intelligence, exponential advancements, and future challenges to be encountered between man and machine. ⁽⁵⁾ There are many supporters on both sides of Kurzweil's predictions, regardless of their belief many aspects of our lives are being influenced and impacted today by these exponentially emerging technologies.

In a famous 2011 scene from the television show Jeopardy, IBM's Watson defeated human contestants. More recently Watson Health has been working on solutions to implement into healthcare. This has been met with mixed results but still shows much promise but perhaps with a longer end game. ⁽⁶⁾

Demis Hassabis and his team at DeepMinds AlphaGo rocked the board game GO enthusiasts by move number 37 and its 2016 AI win over the current world master 9-Dan Go player. ⁽⁷⁾

DeepMinds more recent project, AlphaFold, November 2020, has helped to solve a 50-year-old grand challenge in biology by providing accurate predictions of how proteins fold. ⁽⁸⁾

We have seen many opportunities to utilize AI/ML within oral health. The convergence of innovation, technology and public awareness has created an environment ready for change. The American Dental Association recently announced the creation of an Artificial Intelligence Standards Committee. ⁽⁹⁾ The formation of the Dental Artificial Intelligence Council (DAIC) took place in 2020 as well. ⁽¹⁰⁾ Quintessence has helped sponsor international collaboration in the AI space. ⁽¹¹⁾ Covid-19 has made the world even smaller through digitalized processes, communication and collaboration. This has helped identify and foster synergistic opportunities focused on supporting and promoting movement toward

a more efficient healthcare model. This new model is based upon identification, monitoring and prevention with a focus on value based care. These inclusive organizations comprised of Providers, Industry leaders, and Payors have been created to help guide a new era of optimized care within our profession and for our patients.

AI: What's it all about: making the right decision?

Count the number of F's in the following sentence. This question was presented at a recent meeting attended by a local dental study club.

FINISHED FILES ARE THE RESULT OF YEARS OF SCIENTIFIC STUDY COMBINED WITH THE EXPERIENCE OF YEARS (take 20 seconds)

How many "F's did you see? 3, 4 or 5 not many of us see all 6. We overlook a few "F's" because research says, expert readers don't have to process every word or letter seen to understand. Our brains block out the unnecessary F's and in particular the ones that sound like O"V" (vee) rather than F. This is an example of subconscious control where our minds drive us to not being aware of the F in the OV sound. An AI algorithm would not mistake the OV sound for not being a F. It is interesting that this process can inadvertently lead to an error in decision making. Oral health providers see themselves as expert readers of bitewings, periapical and panoramic films. Similar to not seeing the "F's" this doesn't mean we are efficient and consistently accurate with our data collection and radiographic identification of caries and other findings. The Dental AI Council published a study in December of 2020 consisting of 136 dentists each with over 14 years experience from over 7 countries which showed agreement on caries diagnosis of less than 50%. ⁽¹²⁾ Some studies show that we don't always agree with our own radiographic observations over time when the same image is evaluated separated by 4 – 6 weeks. Standard operating procedures for academic validation studies used to evaluate AI have specific criteria that compare each observer to one another and to themselves using the same image interpretation over time. ⁽¹³⁾ In collaboration with the University of Louisville department of Maxillofacial Radiology and Denti.AI a pivotal study was completed and presented at the 2020 AADR/AIDR meeting, highlighting the ability of AI to assist providers in finding early and incipient decay. In

fact, the AI was close to 2x's as likely to identify findings with incipient and moderate caries. The conclusions stated that using a limited learning data set AI provided a higher sensitivity for caries detection and greater accuracy for incipient sized lesions than observers overall. (see image 1) Further AI training is needed to increase caries detection specificity. This example serves to highlight how simple repetitive tasks performed by oral healthcare providers on a daily basis can be augmented to arrive at a more accurate decision with the help of artificial intelligence and machine learning.

Caries severity	AI	All Readers	Reader 1	Reader 2	Reader 3
Incipient	0.51*	0.22	0.33	0.17	0.17
Moderate	0.51*	0.33	0.50	0.13	0.38
Advanced	0.40	0.52*	0.74	0.35	0.45
Severe	0.58	0.75*	1.00	0.50	0.75

Table 2. Sensitivity for Various Dental Caries Depths. Comparison of sensitivity using the bootstrap method for each reader and all readers as compared to AI for the detection of proximal dental caries at various depths. *Significance p < 0.05

Image 1 - *Image courtesy: Rohit Vadlamani, Bill Scarfe, Tuzoff et al. University of Louisville Dental School and Denti.AI

The example of missing "F's" helps distinguish between the Limbic system of QUICK, intuitive responses and the Neo Cortex SLOW rational, analytical analysis. ⁽¹⁴⁾ Daniel Kahneman, a Nobel Prize winning Economist and Psychologist, describes the way we process thought and how we think, in his book titled: Think Fast Think Slow. ⁽¹⁵⁾ In his book he poses a question:

If a bat and a ball cost \$1.10 and the Bat costs \$1.00 more than the Ball, how much does the Ball cost?

The answer is: ____ (take 10 seconds see answer below)

This simple question helps us to become more aware of our challenges with accuracy, speed in decision making while highlighting the contrast between quick automatic vs slow analytical thought processes. Did you guess 10 cents or were you one of the few who quickly arrived at the correct response of .05 cents? (\$1.05 + 0.5 = \$1.10) The human body sends 11 million bits per second to the brain for processing, yet the conscious mind seems to be able to process only 50 bits per second. ⁽¹⁶⁾ The amount of new medical data we encounter is far beyond any individual's ability to filter and process. It has been



said that in 2020 medical knowledge is doubling every 73 days much more quickly than the 7 years it took in 1980. ⁽¹⁷⁾

Just like the missing F's could there be some data points our mind inadvertently and subconsciously filters out while processing patient data funnels of information? How do we recognize if this data is missing? Missing data points result in less than ideal algorithms being used to arrive at our decision. We could all use a little assistance from trusted artificial intelligent or augmented algorithms providing consistent, accurate and efficient decision support. This would lead to enhanced care, better outcomes, and improved overall health and wellness.

In the book **NOISE: an error in our judgement**, research suggested that as humans our ability and accuracy in decision making is less than perfect and is impacted by outside influences referred to as noise. ⁽¹⁸⁾ Just think about the noise around us each day. As an Oral Healthcare Provider, we are often multitasking between Patient Treatment, Hygiene, Scheduling, Insurance, Radiographic Interpretation, Human Resources, Medical Updates, Business and Personal Interactions. This quick pace requires us to make quick decisions (Limbic System) based upon experience and a lack of external algorithmic decision making support. Adopting a digitalized workflow may help to bring efficiency to this model along with improved communication, patient acceptance and outcomes.

Humans must rely on algorithms to arrive at a consistently accurate decision. ⁽¹⁸⁾ Our ability as Oral Healthcare Providers should not be based upon the speed of data collection but rather upon our ability to process and provide care based upon accurate decisions customized to the individual needs of our patients. AI/ML can help automate this process leading to more efficiency and sensitivity. The correct answer of 6 "F's" or 0.5 cents does not correlate with an individual's intelligence level. We should take pride in consistently arriving at the correct decision rather than the speed at which a decision is made. Artificial Intelligence has augmented our ability for correct decision making. AI decision making is often compared to humans based upon an arbitrary and false level of human perfection. To make a fair comparison we must realize that we are far from perfect in our decision making and are prone to oversight and errors as well. These new

technologies have slowly been woven into everyday life. In many aspects and areas AI and ML have already been accepted, adopted and utilized.

Artificial Intelligence in our lives today:

We often accept these new technologies and innovations in our personal lives and expect our patients to think differently but they are often accustomed to the same experiences as ourselves. Covid-19's global challenges have left us navigating uncertainty, learning and adapting to new routines. Adaptive leadership has emerged to deal with the rapidly changing landscape and the uncertainty ahead. Remote work, Digital meetings, interactions and acceptance of general digitalization has been propelled forward much more quickly than may have otherwise occurred. ⁽¹⁹⁾ We have seen the advent and implementation of Tele-Health into our everyday workflow. We now have the opportunity to accept, reject or reboot into the future. The combination of COVID-19 and the resurgence of AI/ML and the current climate of innovation and technology has created a synergy of opportunity that is abundant and up to us to shape and guide to create transformative change in oral healthcare.

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We have begun to see efficient new technologies making everyday tasks more simple, and available at an instant when needed. Google Translate, Self Driving Cars, Waze, Siri, Alexa, and Facial Recognition have innocuously become integrated into our lives and culture.

Nathaniel Fairfield described the journey of the Google self driving car project (now Waymo) from its inception. Within this story many analogies and similarities exist to where we stand today as the gatekeepers to AI within the Oral Health space.

He describes the experience in that the car becomes a careful thinking (neocortex – slow) driver that doesn't get sleepy, drowsy, drunk or distracted by texts, or children in the backseat. The first million miles is about learning, growing and proving things. The next million miles is about cars driving themselves, getting people where they need to go and making it safe. ⁽²⁰⁾

The Dental profession/industry finds ourselves today at the beginning stages. The Deep Blue / Kasparov



moment that oral healthcare professionals and the public are becoming aware of what AI can do within our profession. Many academic validation studies have been completed and we are transitioning from learning, growing and proving into clinical implementation. We are at a point where we are bridging the gap from testing and development towards successfully providing safe controlled input to improve human decision making to enhance our teams and benefit our patients.

AI and Oral Health

Artificial Intelligence

We have seen AI/ML development in areas of Automated Charting for both new and existing patients, support in identification of pathological and non pathological x-ray findings, insurance processing by providers and payors, voice interaction with practice management integration, listening to phone conversations, margin detection, crown and bridge design and construction, image processing, orthodontic aligner creation and remote monitoring of tooth movements. AI is being used to determine which restorations may last the longest, the need for extractions prior to orthodontics, and predictive modeling of dental pain.^(21,22,23) This work is being done by startups, established industry leaders, distributors, payors, and dental professionals within the private sector and academics institutions. These are indeed exciting times for oral healthcare stakeholders open to innovation and creating change.

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Computer Vision: Radiographic interpretation

The human eye can see 30 shades of gray computer vision is capable of distinguishing between 256 – 1024 shades of gray.⁽²⁴⁾ Computer chips have been improving in line with Moore's law that transistors on a computer chip will double every two years. Improvements in the processing and speed of computers combined with work being done using AI for image recognition lent well to computer vision becoming the doorway for augmented radiographic interpretation support. Radiology was a natural beginning point that was optimized and streamlined by the advancements in digital radiology that have been adopted and implemented throughout healthcare facilities both medical and dental. Parameters for radiographic interpretation exist and are taught in dental school.

There is a lack of calibration and standardization between faculty and students when describing caries on an x-ray. This lends to biases and missed diagnostic findings.^(8b) The ability to work with AI algorithms to help calibrate faculty and students leads to improved standards, communication and consistency within the education process. Gamification of radiographic finding assessment can be used to help train students making the education experience more interesting. Academic centers have started to focus attention on AI validation studies. The use of AI and machine learning (ML) for tooth identification and automated charting can aid in efficiency and accuracy during new patient and follow up examinations.⁽²⁵⁾ The image (image 2) below illustrates the user interface analysis of Denti.AI's cloud based clinical decision support tool used to identify, number and auto populate AI generated findings. These findings are reviewed then processed with AI and confirmed by the provider. Auto-population of existing and new findings can then be completed and documented directly into the patient's chart. Programs like Denti.AI and others continue to improve through the process of machine learning. Interested users can sign up to learn more at www.Denti.AI.



Image 2 - *Image courtesy: Denti.AI

Artificial Intelligence offers a platform from which standardization, calibration and clarity is provided through a cloud based, unbiased, clinical decision support tool. Great lengths have been taken to assure HIPAA and privacy compliance has been met. Using AI to help detect incipient decay can help both providers and patients identify early less invasive and less expensive treatment. One exciting aspect is the ability of computer vision to find incipient lesions that are good candidates for remineralization processes. Monitoring of these processes and outcome assessment can be calibrated as well. AI and ML help support and foster evidence-based

decision making essential for reaching excellence in patient care. When urgent patient visits take place, we often focus on one specific area of concern missing existing surrounding pathology that AI may be able to help identify making these quick emergency visits more efficient for providers and patients.

Studies have illustrated how AI can assist in identifying periapical radiolucency's. The data illustrated below (Image 3) compares AI to readers while identifying periapical radiolucency's. This study performed at the University of North Carolina Dental School used CBCT's as a gold standard. It is interesting to note that the AI had some challenges in the maxillary first molar area where the sinus often overlaps with the image. Human observers also found this area challenging. The data illustrated that both Humans and AI are not always perfect in their identification and findings. AI combined with human observers has shown interesting synergy with enhanced findings in areas such as sensitivity, accuracy and efficiency.

UNC: Detecting Apical Radiolucencies using Deep Learning Technology: A

Sensitivity by location	AI	Readers combined	Reader 1	Reader 2	Reader 3
Anterior maxillary	1.00	0.88	1.00	0.82	0.82
Anterior mandibular	1.00	0.75	0.75	0.75	0.75
Premolar maxillary	1.00	0.75	0.75	0.75	0.75
Premolar mandibular	1.00	1.00	1.00	1.00	1.00
Molar maxillary	0.27	0.76	0.93	0.60	0.73
Molar mandibular	0.94	0.92	1.00	0.82	0.94

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Image 3 - *Image courtesy: Denti.AI: Denti.AI/UNC Hamden,MH, Mol A, D Tyndall, DA, Tuzoff D & L.

Concerns of under and over diagnosis will be monitored with emphasis and movement toward universally accepted standards.

Image 4 - *Image courtesy: Denti.AI / Eric Pulver

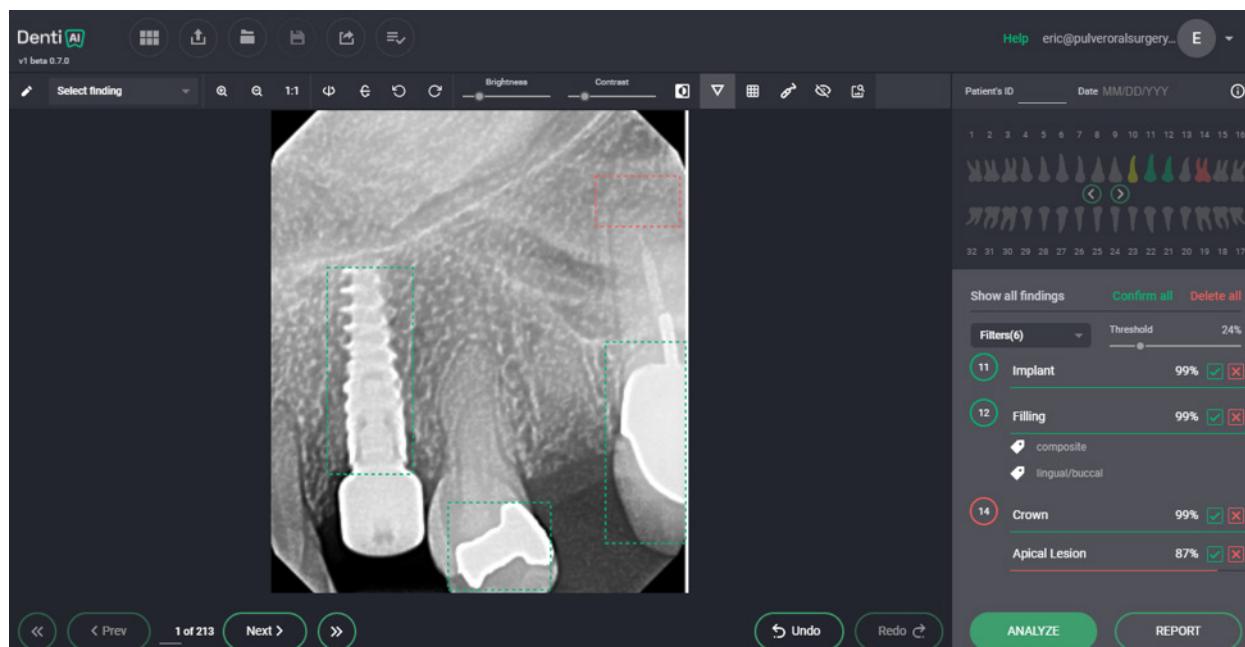
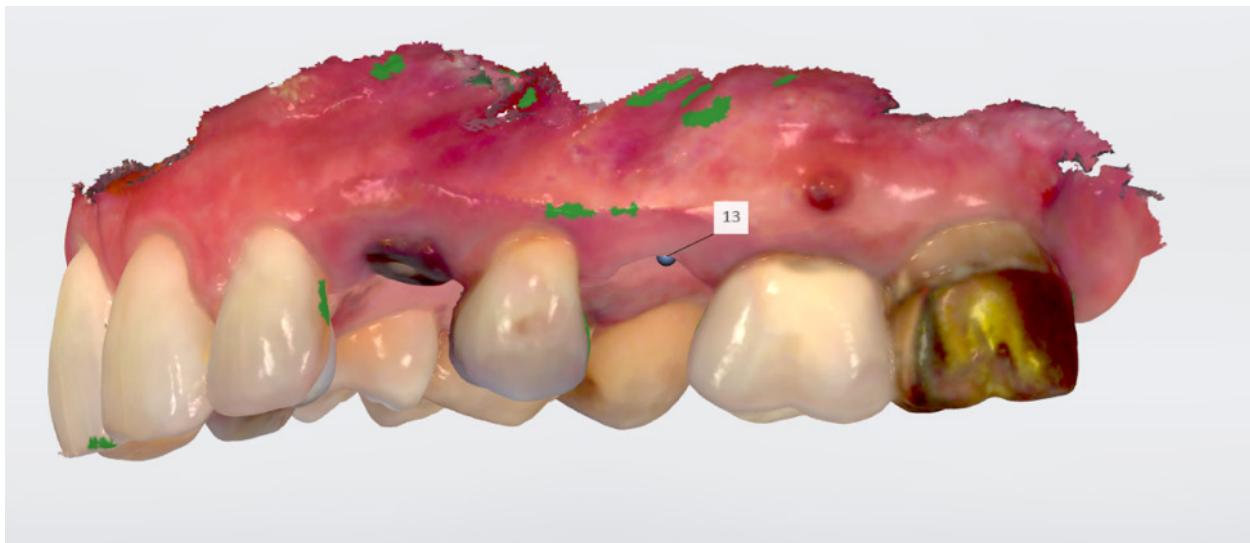


Image 5 - *Image courtesy: Denti.AI / Eric Pulver



The above images (*Image 4 and 5*) represent a routine final implant check and an incidental finding of a periapical radiolucency at the apex of the first molar. The RED (*Image 4*) bounding box on the PA film image illustrated within the user interphase of Denti.AI illustrates an 87% likelihood of infection being present at the first molar (tooth 14). The fistula can be seen and confirmed on the intra oral digital impression taken at the same appointment. This example illustrates how the slight radiolucency may have been overlooked at a quick implant follow up check appointment. The intraoral digital scan was taken to prepare for a possible implant at site number 13 and was used here as clinical evidence illustrating the infected area and fistula. The AI picked up and identified the implant at 11, restoration at 12, missing tooth at 13 and crown/post and endo fill on 14. These findings along with the tooth numbering are documented in the user interphase (UI) odontogram on the top right of the UI. The AI algorithms are rapid taking only a matter of seconds to analyze, evaluate and document findings. The use of AI to quickly scout entire images and help support accurate comprehensive care, in a fast paced world, is a potential gamechanger.

Paradigm shifts in automated claims approval and processing will allow for reduced wait times to begin treatment improving patient experience. The goal will be to move towards automated and instantaneous authorization / approval if processing takes place through accredited and approved AI software. Efficiencies in auto charting will improve chart completion and record

collection compliance as well as reduce data collection time. These **new digitally** based efficiencies will free up time for **valued analogue** Provider-Patient communication opportunities.

It has been stated that AI augmented data entry can reduce the time taken to collect information by as much as 20 times. This new found time savings also comes with improved accuracy. AI and accepting digitalization are directly proportional to enhanced analogue communication (more time to talk) with our patients which is essential for developing trust and understanding desired by our patients. New intelligent voice technology can do more than just recognizing your voice and responding. Solutions have been created to help streamline data and record creation using voice technology. Outcome tracking may lead to provider and patient benefits for both reimbursement (speed and amount) and perhaps reduced premium costs, respectively. Artificial Intelligence has been used to help create ideal crown dimensions from emergence profile, contact points, occlusal morphology and soon contacts. Providers who are printing their own implant guides may soon find the process automated and improving over time based upon powerful AI algorithms working behind the scenes. Digital articulators and smart mouth guards will help facilitate more intelligent design into occlusion and function helping to reduce the challenging sequelae from clenching and bruxism. AI has also been used to create and design reconstruction plates for orthognathic and craniofacial surgery. Augmented and Virtual Reality have allowed us to immerse ourselves into



the operative field. Artificial Intelligence and standard algorithms can be used to help assure our attention is directed to the most important clinical aspects of each case regardless of the complexity. After virtual surgery automated fixation plates and or guides can be created using automation processes powered and influenced by AI. Artificial Intelligence integrated into state of the art inventory systems can track and alert providers about the tools, materials and components necessary to address upcoming scheduled patients. Taking one step further, AI tools can be used to search online Dental Marketplace platforms to find the best products, prices automatically and provide dashboards alerting your team when and where to purchase these items. Another exciting area to consider is home healthcare monitoring through wearables, IoT and Teledentistry/Medicine.

Artificial Intelligence can grow to serve as a trusted second opinion offering consistent, accountable, always there "like a good friend" assurance. Andrew Ng (deeplearning.ai) has described 5 levels of automation within healthcare⁽²⁶⁾. In general, most breakdowns begin with humans only and progresses from an AI observer, towards an AI assistant and then from partial to full automation. AI within dentistry is further along than you may expect.

We have the chance to choose to welcome and guide this new technology into our profession. One day in the future, our colleagues may trust and rely on it to help them provide care and look back and wonder how we ever practiced without it! Innovation is not new to the Dental Industry, we have moved from Analogue to Digital X-rays, Alginate to Digital Impressions, Amalgam to Biomimetic Restorations and Remineralization, Paper to Electronic Health Records and we are well poised to lead the way in the digitalization revolution of healthcare. Not too long ago Oral Healthcare providers were faced with having to start wearing gloves, not many of us today can imagine treating patients without them one day the same will be said about AI.⁽²⁷⁾

AI is in need of champions and ambassadors from within our profession to help guide, train and implement this exciting technology into everyday practice. Perhaps you will choose to be its guide and we can collectively impact transformative change.

Is Today Tomorrow: AI – IoT – Saliva – Systemic Health – Mobile Delivery:

As Oral Healthcare providers we see healthy patients for preventive appointments on a regular basis. They visit for restorative treatment, hygiene and maintenance at least twice per year depending upon their oral health needs. These routine visits offer an excellent opportunity to intervene with expanded preventive care directed at impacting our patient's systemic health. It is important that we do not bias our examinations towards just the dental needs of our patients. The oral cavity is an open doorway into our patient's systemic health. Recent attention has been placed on Oral Systemic health links.⁽²⁸⁾ Missing teeth, periodontal disease, oral biome and associated inflammatory markers provide detailed information related to overall health and wellness. Research has shown that an individual with 5 or more teeth lost at 65 years of age is more likely to suffer from cardiovascular disease, diabetes, and osteoporosis. This subset of patients are also associated with a reduced life expectancy. Those with a full set of teeth at 74 are significantly more likely to reach the age of 100.⁽²⁹⁾

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As Oral Healthcare Providers we are in a unique position to redefine our role within the healthcare ecosystem. By adopting new technology, testing and monitoring the traditional dental office or a reimagined point of care can emerge as an integrative health center impacting both oral and systemic wellness. Artificial Intelligence, Internet of Things (IoT), Mobile and Teledentistry, and many other digital innovations will help us provide, more accurate efficient care, less invasive monitoring, rapid data collection, trends in data, enhanced access of care and more data to be used by smart decision making algorithms.

Can saliva hold the key to knowledge beyond the bacteria present within it? The National Cancer Institute's Liquid Biopsy Consortium has studied blood, saliva, urine, stool and sputum for early indicators of cancer.⁽³⁰⁾ These same studies have shown that saliva is rich in bacteria, enzymes, proteins and genetic material that, if collected and processed properly could be used as early indicators and predictors of disease and support precision and personalized medicine. These tests are available today but are not widely used. This information may lead to development of a **phenotypic**



risk assessment score (PRAS) that could one day be used as a predictor to determine the probable outcome / success of specific treatment plans based upon the individual tolerance of our patients. Each patient can then be provided treatment options and monitoring based upon their unique biologic response predictors. To date Dentists have done exceptionally well considering we have been challenged by not fully understanding our patient's ability to tolerate the prescribed treatment we choose to deliver. The amount of integrative data required to provide these types of insights and predictions will be dependent upon, and expedited by, incorporating Artificial Intelligence and Machine Learning into our workflow. If we remain open to new ideas and technology, abundant opportunities will present providing efficient customized information to offer the best care to our patients.

Conclusion:

Being open, aware and knowledgeable about AI can help guide and shape how our personal and professional lives are impacted.

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Philosophical beliefs, ideas and definitions of consciousness, ethics, research, funding and the challenges, dangers and risks associated with general artificial intelligence are powerful forces through which we must navigate to safely and successfully move AI from student, assistant, teammate to teacher.

We should remain open to training, monitoring, and supporting machine learning in a controlled, ethical and safe manner. Transformative change carries with it tremendous responsibility and effort, which I believe as Oral Healthcare professionals our industry is poised to provide and help lead the way forward. As a profession, we have an opportunity to provide standardization, calibration and clarity, better communication and enhanced outcomes, leading to improvements in overall health and wellness. Together we can make change happen and help our profession find a new place as a primary care provider and ambassador of prevention within the healthcare ecosystem of tomorrow.



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Dr. L Eric Pulver received his Doctorate of Dental Surgery from the University of Toronto, Canada in 1989. He completed a hospital based general practice residency at Mount Sinai Hospital in Toronto in 1990 followed by a fellowship in the osseointegration unit, Department of Prosthetic Dentistry, University of Toronto in 1991. Dr. Pulver graduated with a Diploma in Oral and Maxillofacial Surgery from Northwestern University in Chicago in 1995. He served as an assistant professor at Northwestern University Dental School prior to becoming the Director of Oral & Maxillofacial Surgery at the University of Chicago Hospitals from 1999-2006. He contributed to the first human pivotal study using Bone Morphogenic Proteins for sinus lift procedures while at the University of Chicago. He is currently an adjunct instructor at Indiana University Dental School and co-founder of Real World Dentistry, an interdisciplinary treatment planning course taught to the graduating class of IU Dental students since 2008. In 2020 he was awarded an honorary Alumni at Indiana University Dental School. Dr. Pulver has been a board member of the Northwest Indiana Dental Society for many years and currently serves as co-head of the curriculum committee. He was appointed as an Advisor to the Dental Study Club of Northwest Indiana a component of the Seattle Study Club. He is the Chief Dental Officer of Denti. AI, a cloud based Artificial Intelligence clinical support decision tool providing standardization and calibration for oral healthcare providers. He has been selected as a working member on the recently created American Dental Association Standards Committee on AI and is a member of the Dental AI Council. He previously served as the team Maxillofacial Surgeon for the Chicago Blackhawks in the National Hockey League from 1999 – 2006. Dr. Pulver is the founder and creator of All on Everyday, (www.ContinUdent.com) an online course directed at team development focused upon team education and incorporation of the immediate fixed full arch (All on 4) solution into Everyday Dentistry. He was recognized by Global Summit as a Top 100 Global Doctor in 2021. He is a member of the American board of Oral and Maxillofacial Surgeons, a Fellow of the Royal College of Dentist of Canada, and a fellow of the American College of Dentists.

Dr. Pulver has contributed to scientific articles, research, and numerous virtual learning education outlets. He has lectured and presented nationally and internationally on innovation and technology with specific interest in Artificial Intelligence, Virtual Dentistry, Oral Systemic Health, synthetic biology, Salivary biomarkers and immediate full mouth surgical reconstruction. He serves as the chief innovation officer of Revere Dental Partners an Oral Healthcare VC fund.

Dr. Pulver's interests are diverse. He graduated from Second City Comedy Chicago where he completed Improv levels A – F and Stand up in 2016-17. He serves on advisory boards ranging from startups to emerging and established entities. He brings a unique perspective ranging from academics, business, entrepreneurship, and creativity. He is an avid skier, intermittent fast, amateur biohacker, futurist and likes to exercise and enjoy family, friends, wine, and a little bourbon.



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UPCOMING

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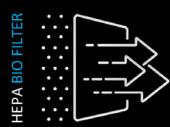
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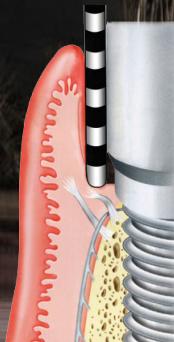
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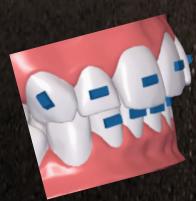
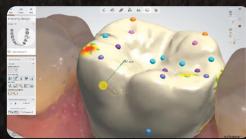
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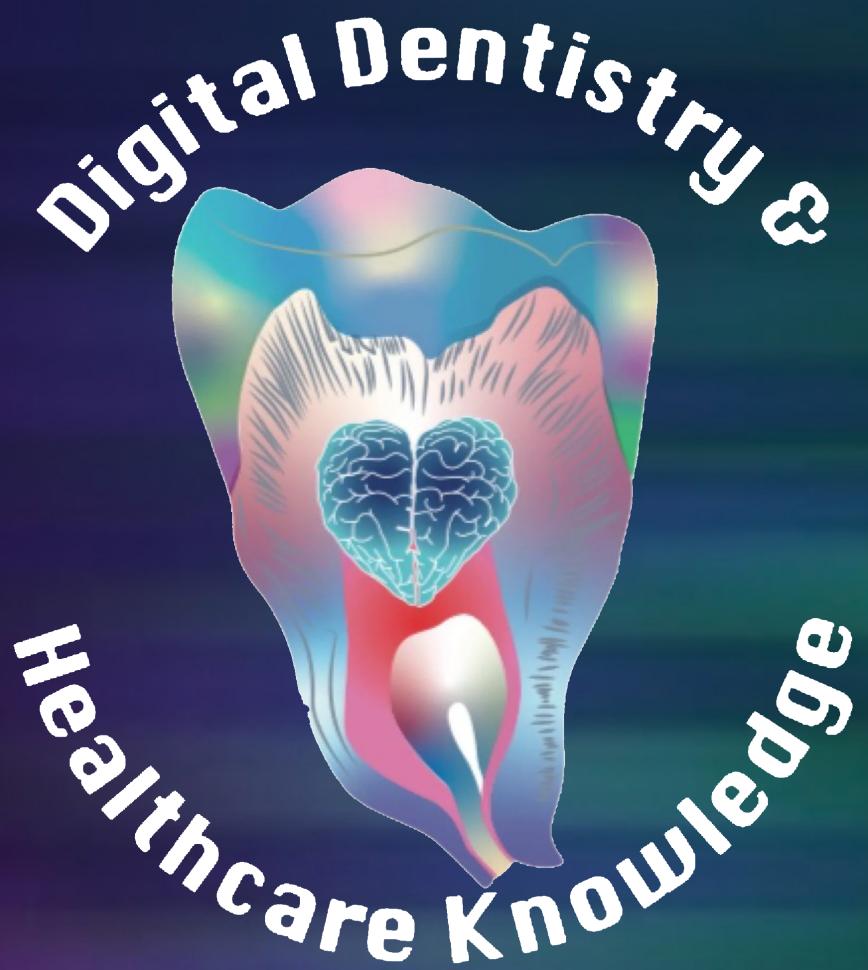
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