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DECEMBER 2022

ABOUT FACE

RETURN TO BEING CONNECTED

Medical management of dental caries

Post-op pain management during the opioid crisis

New therapeutic possibilities for gum disease

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About face: Return to emotions, return to connections

Fay Goldstep, DDS, FIADFE, FASDA

During the last two-and-a-half years, we have lived a huge sociological experiment that will be studied for decades to come. The impact of the COVID measures will be discussed and dissected ad nauseum, with no clear consensus likely as the outcome. What we do know is what we missed the most – the joy of human connection.

We connect with each other mostly through visual cues. When masking was instituted, **we lost the face,** which provides so many of the cues to human emotions. The *face* is the link between people. Through the *face* we know how someone feels. Are they happy, sad, angry, anxious, excited, disgusted, afraid, confused, surprised? As children we learn how to read these cues and we continue to hone our emotional detective skills through life. We learn to judge how and when to interact with others. Does this person like me? Are they in a good mood? Are they angry? Are they upset about something? Will they be open to my suggestions, or should I try later?

If we were dogs, we would show all our emotions in our tails and masking would not have made a difference. However as humans, when the masks came on, we shut each other out. We closed the connection. This was particularly harmful for young children who do not yet have the life experience of facial connections. They have now been conditioned to shut out others because they may be hazardous.

Thank goodness mask mandates have been lifted! Hopefully the harm that these mandates caused will be short-lived, and we can return to showing our emotions, picking up visual cues, and interacting with each other in an open human way.

We as dental professionals serve the face through the smile. We are instrumental in providing our patients with the means to show their feelings and to get their emotional message across. This issue of *Oral Health* will give you fresh ideas on how to help them do this. Let's get reading to learn new concepts and new techniques and get our patients smiling.

Happy reading! Happy holidays!

Oral Health is pleased to present the voices of our Editorial Advisory Board members in this forum, which allows writers to share their personal thoughts, opinions, viewpoints and experiences. We want to ensure our tradition of serving our readers the very best in clinical and editorial content continues and we thank all the members of our Editorial Advisory Board for their efforts in making this happen. We welcome your comments and feedback. Feel free to share your thoughts with us through letters to the editor (amy@newcom.ca).

Dr. Fay Goldstep has lectured nationally and internationally on Proactive/Minimal Intervention Dentistry, Soft-Tissue Lasers, Electronic Caries Detection, Healing Dentistry and Innovations in Hygiene. She has been a contributing author to four textbooks and has published more than 100 articles. She sits on the editorial board of Oral Health. Dentistry Today has listed her as one of the leaders in continuing education since 2002. Dr. Goldstep is a consultant to a number of dental companies, and maintains a private practice. She can be reached at goldstep@epdot.com.

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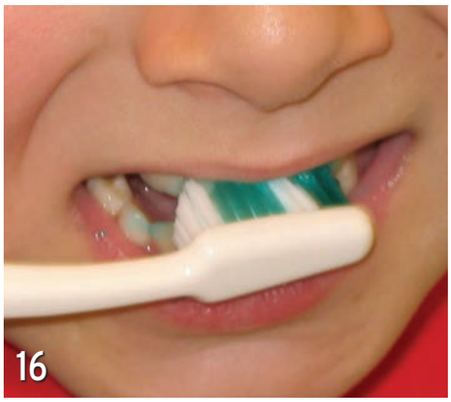

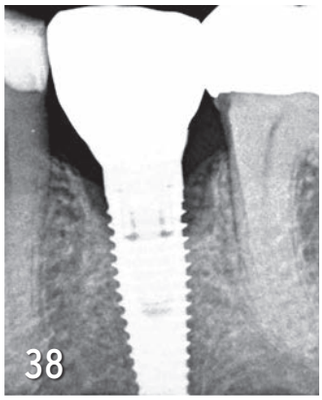

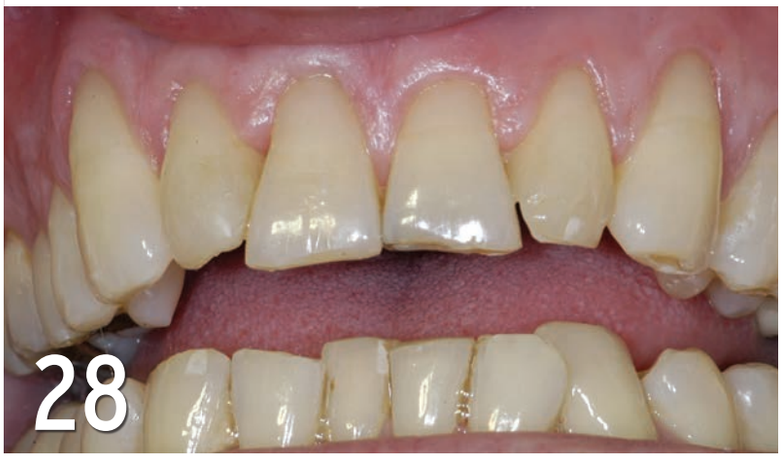

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A NEWCOM Media Inc. Publication

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ISSN 0030-4204

Yearly subscription rates: Canada 1 year $64.95 + taxes, 2 years $107.95 + taxes (GST/HST #103862405RT0001); U.S. 1 year $70.95; Foreign 1 year $107.95; Single copy Canada & U.S. $10.00; Single copy Foreign $10.00. Printed in Canada.

Oral Health is published monthly + a special issue.
CANADA POST Publications Mail Agreement No. 40063170.
Changes of address notices and orders for subscriptions are to be faxed to (416) 614-8861 or mailed to Circulation Department
–
Oral Health, 5353 Dundas St. W. Suite 400,
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CHAIRSIDE CHATS
A Word With...

DR. AMIN SHIVJI
CEO and Co-Founder of 123Dentist

What is one thing you know now that you wish you had known at the start of your career?

I wish I had a better understanding of how hard it is to run a business. Being a great dentist doesn't necessarily mean you're a great business owner. That's why we feel it's important to give back to the dental community, such as helping a struggling dental practice during a pandemic where we can. It's the right thing to do.

What are the two key qualities you look for in a new team member?

The two main things we look for in a new team member is cultural fit and professional competency. It starts with culture: we are a close-knit team, and we believe strongly in customer service, so we look for people who thrive in a team environment and want to deliver excellence. And, of course, we want skilled, qualified professionals.

What is the one piece of equipment or technology you could not work without?

Personally, my phone. It's like the remote control of your life. It truly is a lifeline to communicate with family, friends and my 123Dentist family. I review x-rays on my phone and share information with colleagues. In the clinic, a fully digital office is very important for the team and patient care. It allows us to provide better patient service and care.

What is the most important piece of advice you would give to a new practitioner?

First, make the patient your priority. Focus on the treatments you can do and refer everything else. Second, dentistry is about continuous learning and building relationships. Experience and knowledge will guide your treatment planning, and mentors will help take you to the next level. It just makes you a better dentist.

What do you do to make sure you maintain a healthy work-life balance?

I love coming in to work because we've created a great culture. That said, I make time to take holidays and I encourage everyone to do the same. Taking care of yourself means you can take care of others better. I love to travel and ride my motorcycle. I am also a car enthusiast.

What do you consider to be your best and worst qualities?

I have the same quality for both, which is being too nice. It is easy to see how that is a good quality, but I think sometimes being too nice means that I don't make tough decisions as quickly as I should.

What profession, other than your own, would you like to attempt?

I would love to be a pilot. It is the ultimate freedom.

Dr. Amin Shivji was born in Africa and moved to Vancouver in 1973. He graduated from the University of British Columbia in 1989 with a BSc in Biology and entered the Faculty of Dentistry at UBC, graduating in 1993. He opened his first practice in Vancouver in 1993 and still practices today.

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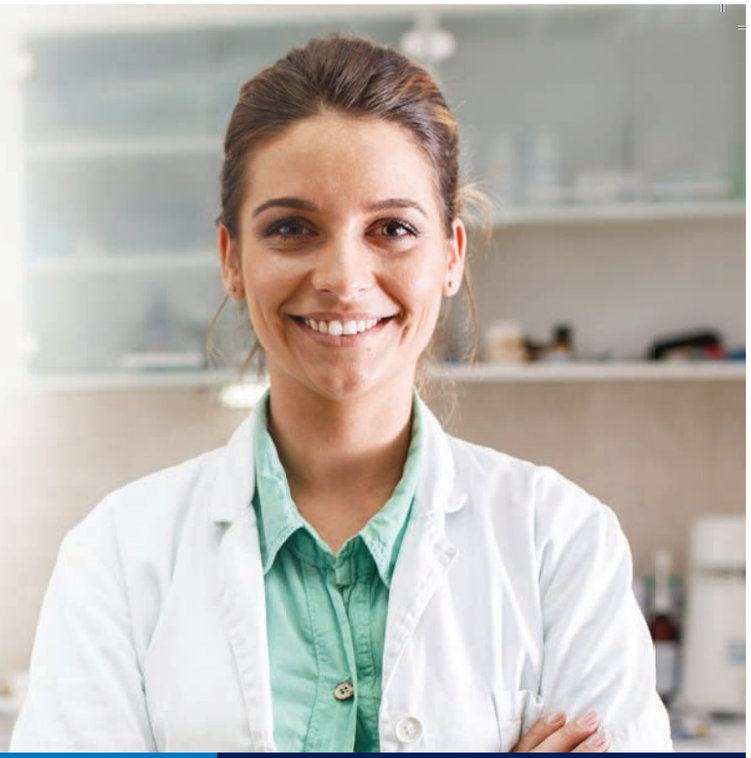

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Scan to see Dr. Amin Shivji's video

datadriven DENTISTRY

2022 Round-Up!

Attracting New Staff to Your Practice

Acquiring new staff has been a challenge this year but there have been a few options available for practice owners. Hiring a newer graduate may require more work in the onboarding and training process but allows you to mold and mentor the employee. Dental temp services have also greatly helped the industry during this time.

31% of dentists say **hiring/retaining staff** is their **biggest stressor** at the moment.

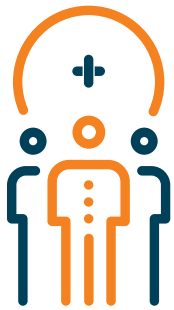
Assistants rank as the **#1** staff position that dentists have **hired in the last year.**

Maintain Safety Protocols to Protect Your Body and Mind

COVID-19 protocols and restrictions continued to ease this year, but it was important for dentists to keep up their safety measures. Our survey showed that providing sufficient safety protocols helped reduce staff stress, which helps with retaining staff. While PPE supply costs did rise, patients and staff remained safe.

ONLY **1/2** of dentists are following **protocols and guidelines** to cope with the stress of safety concerns.

79% of dentists agree that **managing staff stress** has been a challenge.



Treating Staff as an Asset, Not an Expense

Treat staff salaries and benefits as investments, not expenses. Check in with your staff. Acknowledge the stresses they are experiencing and work to help them in any way you can. Put on fun events in and outside of your office. If you don't want to deal with the hassle of hiring new staff, treat your current staff well to cultivate appreciation and loyalty.

30% of dentists have **offered more flexibility** and **accommodations** to reduce staff stress.

1/2 of dentists say they are **coping with stress** by having a better **work-life balance.**

It's Time to Update!

The transition of using more digital platforms to communicate has been happening for years and the pandemic only increased the need for it. Of the dentists that have been making changes, half of them are using text messaging more. Other new ways to communicate with your patients include social media and automated communication platforms.

42% of dentists have changed the way they are **communicating with patients** in the last two years.

NEARLY **1/2** of dentists are **text messaging** more to communicate with patients.

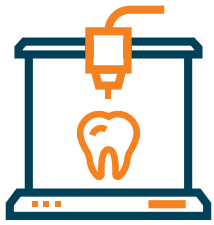
Word of Mouth Stays On Top

Despite all of the new marketing methods available, dentists are still finding that word-of-mouth marketing works best to attract patients. Therefore, from the customer service to the clinical work, ensuring you and your staff are delivering the best work possible should always be your number one priority. Provide the best care so your patients can't help but recommend you!

Word of mouth ranks as the **#1** best way to **attract new patients,** according to dentists.

1/3 of dentists agree **online user reviews** is a way they a**ttract new patients.**

Planning Your Purchases



Despite the financial hits from the pandemic, over half of our reader respondents still planned on purchasing new equipment or technology this year. Operatory equipment was the most popular item planned to purchase and nearly half of dentists agreed they find out about new technology from events and tradeshows.

Operatory equipment was the **#1** thing dentists **planned to buy** in 2022.

NEARLY 1/2 of dentists had **no plans to buy new technology or equipment** in 2022.

Retirement Trends in Dentistry

Many dentists have hastened their plans to retire due to the stress of the pandemic. This gives newer dentists an opportunity to take over for their mentors or buy their own practice. In fact, selling through a private sale is the most popular way dentists hope to retire.

1/3 of dentists agree the pandemic **hastened their plans to retire.**

43% of dentists would prefer to **retire through a private practice sale.**

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PROACTIVE INTERVENTION DENTISTRY

Artificial intelligence in clinical care: How dentists are using AI to improve diagnostics and patient communication

Cindy Roark, DMD, MS; Kyle Stanley, DDS

INTRODUCTION: OLD JOB, NEW TOOL

Since the 1950s, when x-ray photography came into widespread use in dentistry, the radiograph has been a dentist's primary diagnostic tool.[1] It is easy to see why: Only a tiny fraction of what a radiograph shows can be seen by the unaided eye.

In other branches of medicine, radiology is its own specialty; in dentistry, it is a sideline of the clinician, a brief stop on the way to prophylaxis and repair. Accurate interpretation of dental radiographs is difficult. Images vary in quality and can be full of ambiguities. Not surprisingly, several studies have shown that different dentists, looking at the same radiograph, interpret features in different ways and arrive at different diagnoses and different estimates of the depth and severity of lesions.[2] Forty percent of estimates of cavity depth are wrong. We miss between a quarter and half of periapical radiolucencies. In one study involving thousands of radiographs, three dentists were in full agreement about a given radiograph only four percent of the time.[3] Patients sense this, and approach dentistry with a certain wariness.

About 15 years ago, radiologists working with cancer oncologists began using a new technology to assist them in interpreting radiographs of lungs and other internal organs.[4] This new technology was what is broadly known as "artificial intelligence," or AI for short. AI, in the form of digital image analysis, has now become an accepted tool in oncology, and has shown an ability to detect abnormalities that is equal, and sometimes superior, to that of human radiologists.[5,6]

It was only a matter of time before that same type of AI would be implemented in the world of dentistry, where interpretation of radiographs is so fundamental to clinical practice. The dental field turns out to be a fertile one for AI, which requires intensive "training" using vast amounts of data tagged by expert analysts. If ever there was a health discipline with vast amounts of data in existence, it is in the form of radiographs in dentistry. The proof has been in the practical performance of dental AI. As it does in oncology, digital image analysis matches or exceeds the performance of dental experts in detecting and identifying both normal and abnormal features.[7]

THE BUSINESS CASE FOR AI IN DENTISTRY

A frequently cited Reader's Digest article originally published in 1997 reported the experience of a writer who visited 50 dentists in 50 states and got almost that many diagnoses and treatment plans.[8] As you would suspect, they diverged widely in complexity and cost. There is no way to know whether that article moved the needle on dental reputations, but it certainly resonated with the widespread perception that dentistry can be a very subjective business.

Scientifically conducted studies have yielded the same result; dental diagnosis is highly inconsistent – you might even say unreliable.

While some unscrupulous practitioners could profit from the ambiguity of radiographic evidence to foist unnecessary treatments on patients, most of us strive to bring as much accuracy and consistency of diagnosis into our work as we can. Digital image analysis can only help. It presents its results to both dentist and patient, chairside, as an image of the radiograph with areas of concern highlighted and tagged. As an aid to the dentist, it ensures that nothing will be overlooked while allowing him or her to make the necessary professional judgments about the importance of different criteria and how to proceed with treatment. As a service to the patient, it clarifies ambiguous imagery and conveys a reassuring impression of precision and objectivity. The AI-analyzed radiograph feels like a second opinion delivered in real time.

AI also has several advantages over human radiographers. One is sensitivity, a function of its ability to make extremely fine grayscale discriminations. Another is that it is never tired, inattentive, distracted, forgetful or rushed. In other words, it never makes careless mistakes. But perhaps the most important is

Cindy Roark is the Senior Vice President and Chief Clinical Officer at Sage Dental Management and a member of the Harvard School of Dental Medicine Board of Fellows. Dr. Roark received a MS in Health Care Management degree from Harvard University and earned her dental degree Magna Cum Laude at the Henry M. Goldman School of Dental Medicine at Boston University. **Kyle Stanley** is chief clinical officer at Pearl, an AI company specializing in diagnostic and business analytics solutions for the dental industry. A graduate and former faculty member of USC's Herman Ostrow School of Dentistry, Dr. Stanley's research has been published in international dental journals. His private practice is in Beverly Hills, CA.

that it is a tide that lifts all boats. It never stops learning. AI has the potential to incorporate the collective knowledge and experience of a vast number of practitioners and patients, and to make its power available to all.

Digital image analysis is not the only kind of AI that can be useful to dentists. To a greater degree than most other medical professionals, dentists are entrepreneurs. In private practice, they juggle the dual roles of business owners and care providers. AI and AI-related software can take on many of the routine tasks involved in running an office, simplifying the managerial side at the same time as it improves performance on the clinical side. Conveniently, as business owners dentists are not only in a position to benefit from AI, but also to make the decision to acquire it.

For DSOs, AI not only increases consistency in diagnosis, but also makes it possible to identify clinicians who tend to over- or under-diagnose certain conditions. In the context of access to a large array of patient records in different localities, it opens up the future option of longitudinal analyses of patients' dental health over time, and of detecting potential relationships between dental health, general health, geography, nutrition and other environmental factors.

HOW IT WORKS

It may seem hard to understand how a computer can be taught to recognize caries by showing it a lot of pictures of caries, but it is not that different from how we ourselves do it. Newborn babies, too, must learn to organize visual data into objects; they do not come into the world with built-in recognition of dogs, cats, and automobiles. The programming technology used in computer vision is called a "neural network", because its structure and operation are broadly analogous to those of an animal or human nervous system.

Like the human retina with its rods and cones, the computer takes in a raw image in the form of a large collection of pixels. It finds relationships among them – edges, gradients, amounts and locations of color, light and dark, and so on – and compares those relationships with an internal catalog of object-related relationship sets, looking for a close match.

The hard part is creating that internal catalog in the first place. The process is called "deep learning", a somewhat dramatic sounding term for finding mathematical commonalities in a large variety of visual records of the same class of thing. Having learned from 10,000 pictures of different cats, the computer can recognize any new cat, and will not be fooled by a catlike dog or other feline. The results are astonishingly precise. The computer will recognize not just any cat, but a particular cat; not just any face, but your face, even turned sideways, or in a crowd, or partly covered by your N95.

To train a machine learning system for use in dentistry, dental radiologists annotated thousands of radiographs. From studying those annotated radiographs, the AI learned to identify the visual signatures of a wide range of both normal and abnormal conditions. Of course, the annotators did not always agree on every point. When they differed, the AI recorded the uncertainty as a probability. The result is a machine that embodies the collective skill of a large team of expert radiograph readers and is capable of learning and refining its abilities by continuous feedback.

AI IN ACTION

From a dentist's standpoint, using AI technology to annotate x-rays can improve multiple areas of current frustration. For instance, a recent study conducted by the corporate consultancy L.E.K. ranked alleviating administrative burden and desire for better work/life balance as the primary drivers for job selection. AI can impact both. From the dental claims administrative side, annotated radiographs help to remove the subjective elements of claims review. More precisely, there are now objective measurements attached to a tooth, which removes the need for a reviewer to decide if a tooth is missing 40% or 50% tooth structure in order to adjudicate the claim. Inconsistency of claims review has traditionally been an area of contention for dentists, and AI allows for a streamlined, unbiased review to occur.

Additionally, feedback from clinicians working in practices supported by the US-based DSO, Sage Dental, which ran a pilot deployment of clinical AI software, unanimously reported that they felt less exhausted and experienced lower levels of job-related stress when using the software. Several reasons account for this. Dentists view well over 300 radiographs per day, on average. Statistical variability of diagnosis will occur based on everything from the time of day to how rushed the clinician is at the time of the exam. We live in a litigious climate, so the clinician's worries about "missing things" is certainly a stressor. Add eye fatigue and other operative stresses, and the perfect recipe for burnout exists. Incorporating AI technology helps improve both work/life balance by eliminating stressors and relieves the administrative burden by creating a single version of the data upon which a claim is reviewed.

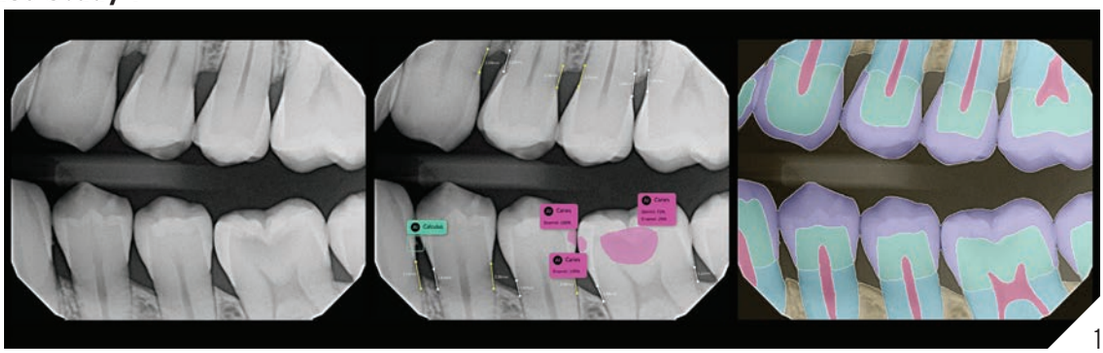
Innovative clinically assistive AI technologies deliver improved, consistent patient diagnosis and increased revenue on a per-patient basis. And while revenue is never the primary goal, it certainly helps mitigate the costs associated with implementing adjunctive technologies. To test this thesis, we sampled pilot patient cases to evaluate performance measures, patient treatment acceptance, and overall patient satisfaction. The case studies below are illustrative of the overall pilot group and indicate enhanced disease detection, patients' understanding of their disease state, and trust in diagnosis.

CASE STUDY 1: PULL MY TOOTH

AI PERSUADED THE PATIENT TO SAVE #36 AND ADDRESS #35

This patient presented to the office in severe pain and just wanted "his tooth pulled." The doctor was able to use *Second Opinion*, a real-time AI pathology detection aid, to help the patient see both the source of the pain (i.e. decay in proximity to the nerve on #36) and the fact that most of the structure of the tooth could be saved. The AI software also showed a very small cavity on #35-d

Case Study 1



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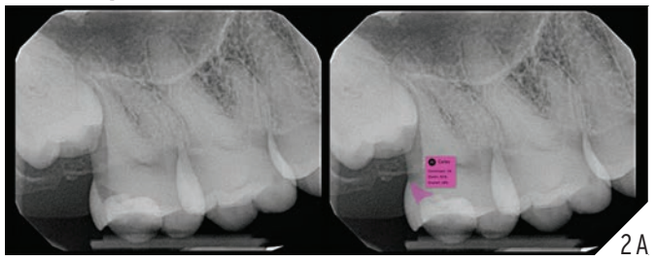
Pull My Tooth.

Case Study 2



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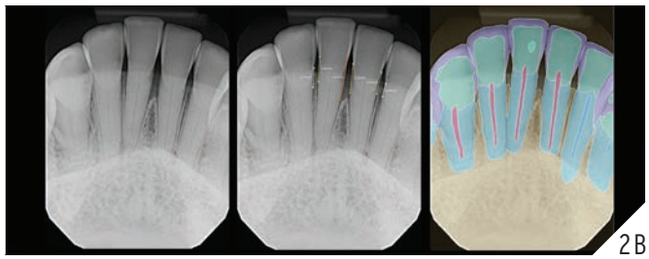
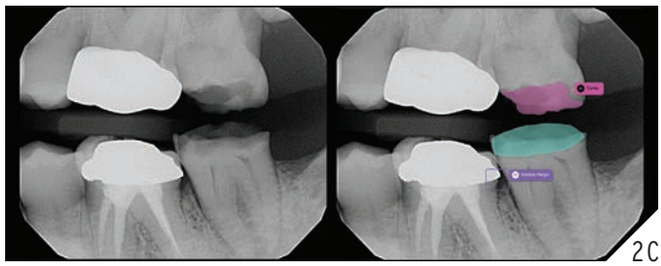


2B

"My 'Free Cleaning.'"



2C

that was not visible to the naked eye when performing the visual exam. The office was able to address both of these concerns on the same day, and to treat this patient's pain without extraction. Two things occurred that would not have occurred without the assistance of AI. One, the patient was able to address the incipient decay on #35 with a less invasive, lower-cost treatment than would have been required to address decay that had progressed over the six months or more leading up to their next visit. Second, the patient made a healthier more conservative choice for treatment on #36. In essence, the objective ability to see the decay, versus merely trusting the dentist, allowed the patient to make a better decision by saving the tooth.

AI-INFLUENCED PRODUCTION IMPACT

36 Endo
36 Porcelain/Ceramic Crown
35 DO Resin
Comprehensive Exam

CASE STUDY #2 MY "FREE" CLEANING

An elderly patient presented to the office simply wanting her "free cleaning" and no other work. She was adamant about this. The office team again used *Second Opinion* to provide her with an AI-driven visual walkthrough of all conditions detected in her x-rays, including precise attachment loss measurements and localized annotations of impaction-influenced decay, an open margin on an existing restoration, as well as a missing crown. She proceeded to accept periodontal scaling and root planing (SRP) treatment and is scheduled to start treatment on #17, #27 and #37, as well as extract #18. This patient indicated that she had been told about the attachment loss on a prior visit but did not accept treatment because she was not certain that it was a valid concern. The colour-coded measurement annotations influenced her decision to accept treatment on this visit.

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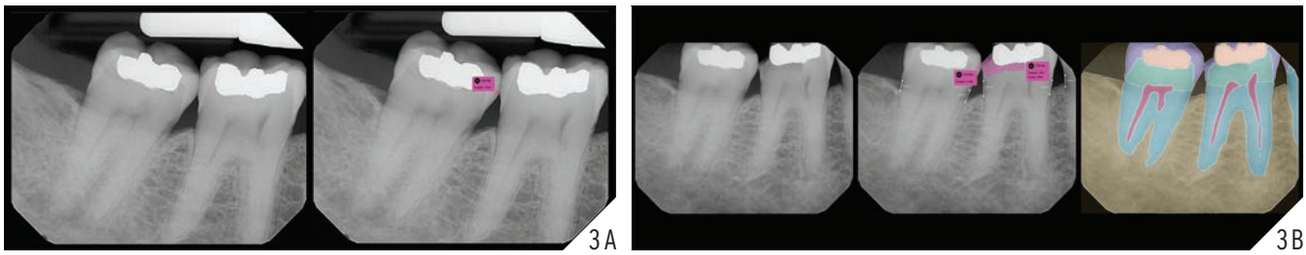
Case Study 3



3A 3B

Fix My Cracked Tooth. A. 2016 B. 2020.

AI-INFLUENCED PRODUCTION IMPACT

SRP
27 Buildup
27 Porcelain/Ceramic Crown
37 Porcelain/Ceramic Crown
17 Porcelain/Ceramic Crown
18 Removal of Impacted Tooth

CASE STUDY #3 FIX MY CRACKED TOOTH

This patient presented to our office as an emergency patient with a broken #46. The office team utilized the AI software to show the patient that they had both a fractured #46 and mesial decay on previously filled #47. The patient clearly understood from the annotated images why something that did not yet hurt should be addressed. The office was able to address the patient's chief concern on #46 as well as #47 on the same day, saving the patient both time and money in the future. The patient noted that she was impressed with the technology, adding that it helped her better understand her disease state.

AI-INFLUENCED PRODUCTION IMPACT

46 Indirect Pulp Cap
46 Buildup
46 Porcelain/Ceramic Crown
47 Buildup
47 Porcelain/Ceramic Crown

COMPREHENSIVE EXAM

From a patient's perspective, these annotated images clearly went a long way in terms of helping them see, understand, and take action to treat their respective disease states. With AI technology gaining in popularity, studies confirm that patients are now extremely receptive to the concept of AI-enabled assessments in dentistry. A recent L.E.K. Consulting study showed that 61% of all patients are very or extremely receptive to annotated x-rays and 59% are willing to switch providers in order to receive exam annotations and treatment supported by artificial intelligence. Similar findings were made in a patient trust and technology survey where 71% of the 600 U.S. dental patient respondents reported that they would be more likely to trust a diagnosis from a dentist who was using AI to assist in disease detection.[9] The time to leverage this technology across the dental field has arrived.

CONCLUSION

Some dentists may have concerns about being replaced by robots, but we expect those fears to dissipate when the convenience and productivity of the AI assistant become well known. AI technologies do not provide care, and so AI will not replace dentists; it will assist them. In the next few years, we anticipate widespread adoption of dental AI; in fact, it will become an expected adjunct to the x-ray camera. We expect treatment costs to become less unpredictable and variable, and patients to feel increased confidence in the objectivity of their dentists.

Over the longer term, we hope to see increased use of population-wide "big data", including dental data, to provide new insights into general health and its connections with dental health. When privacy concerns have been addressed, AI should go hand in hand with the digitization of health records to improve patient care both within and outside of the field of dentistry. OH

Oral Health welcomes this original article.

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PROACTIVE INTERVENTION DENTISTRY

Medical management of dental caries: "Be a knife doctor AND a pill doctor"

Joel H. Berg, DDS, MS

INTRODUCTION

When thinking about managing dental caries as a disease, and not just the outcomes, one might look to a health network, to see how they characterize the management of that disease, as they would with other health conditions. If you were to look at the Mayo Clinic as a source, you would find this description of how to manage dental caries[1].

"Regular checkups can identify cavities and other dental conditions before they cause troubling symptoms and lead to more-serious problems. The sooner you seek care, the better your chances of reversing the earliest stages of tooth decay and preventing its progression. If a cavity is treated before it starts causing pain, you probably won't need extensive treatment.

Treatment of cavities depends on how severe they are and your particular situation. Treatment options include:

Fluoride treatments. If your cavity just started, a fluoride treatment may help restore your tooth's enamel and can sometimes reverse a cavity in the very early stages. Professional fluoride treatments contain more fluoride than the amount found in tap water, toothpaste and mouth rinses. Fluoride treatments may be liquid, gel, foam or varnish that's brushed onto your teeth or placed in a small tray that fits over your teeth.

Fillings. Fillings, also called restorations, are the main treatment option when decay has progressed beyond the earliest stage. Fillings are made of various materials, such as tooth-colored composite resins, porcelain or dental amalgam that is a combination of several materials.

Crowns. For extensive decay or weakened teeth, you may need a crown – a custom-fitted covering that replaces your tooth's entire natural crown. Your dentist drills away all the decayed area and enough of the rest of your tooth to ensure a good fit. Crowns may be made of gold, high strength porcelain, resin, porcelain fused to metal or other materials.

Root canals. When decay reaches the inner material of your tooth (pulp), you may need a root canal. This is a treatment to repair and save a badly damaged or infected tooth instead of removing it. The diseased tooth pulp is removed. Medication is sometimes put into the root canal to clear any infection. Then the pulp is replaced with a filling.

Tooth extractions. Some teeth become so severely decayed that they can›t be restored and must be removed. Having a tooth pulled can leave a gap that allows your other teeth to shift. If possible, consider getting a bridge or a dental implant to replace the missing tooth".[1]

It is noteworthy, that there are very few other human conditions/diseases where the focus of the effort starts mainly with "surgery".[2]

PREMISE

Dental caries is the most prevalent disease in humans. It affects nearly all in their lifetime. Yet, even with this exceptionally high prevalence, the disease itself is rarely effectively treated.[3] Rather, we generally wait for the outcomes of the disease in the form of needing to carry out various and often extensive forms of restorative dentistry. This "need" to wait and only late in the game perform restorative treatments is primarily due to the fact that we cannot see caries lesions clinically, or radiographically until such time that the lesions are cavitated. At the stage of cavitation, the caries lesions do require restorative intervention. *(Fig. 1)* We become a "knife doctor".[4]

Over the last decade, various technologies have evolved which will eventually allow us to treat caries medically and not only surgically. In our counterpart profession of medicine, there are two distinct types of providers. There are those who pursue "medical" careers, and those who choose surgical careers. In dentistry we are both–"knife doctors and pill doctors". Yet, we have not been able to manifest the "medical" part of dental caries disease treatment

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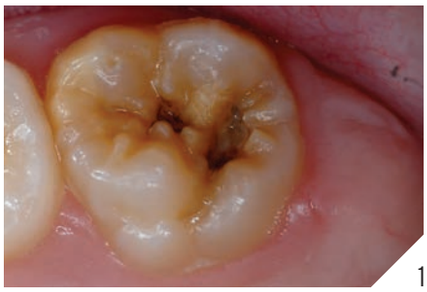
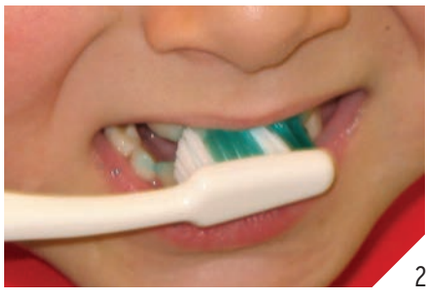




1. Large cavitated caries lesion requiring restorative treatment. **2.** Medical management involves a focus on home care.

because of the lateness of detection of the lesions. Although we are strong and engaging in empirical prevention the form of using fluoride products, encouraging appropriate diets, and engaging in proper oral hygiene, *(Fig. 2)* we cannot entirely prevent the manifestations of dental caries due to its "invisible" state at the early stages.[5]

The idea of a caries management continuum has been described in previous publications.[6] This continuum discusses the fact that at the earliest stage, one should look at every aspect of the caries process. Caries is a disease caused by biofilm acid production which begins to demineralize the tooth surface, usually subsurface, prior to cavitation. This acid production and disease production coincides with various opportunities to treat the disease if the disease process could be identified on a localized basis before cavitation. Although there are interventions available *in vitro* at various early stages of lesion formation, these interventions cannot be deployed clinically because the clinical detection of the lesion at that early stage is not possible. We therefore resort to late identification, and therefore relatively late treatment on the *continuum*[6] in the form of restorative dentistry.[7]

CARIES RISK ASSESSMENT

The necessary but not sufficient conditions to become a "Pill Doctor" as much as a "knife doctor" is via the use of various caries risk assessment tools.[5,8]

We have been exposed to an array of caries risk assessment tools over the last decades. Most of the used tools to date are of the questionnaire, health screening variety. Many of these are outstanding and sensitive tools for the identification of *who* may be at risk for future caries lesions. These tools provide a platform upon which we can have a discussion with our patients regarding the elements of risk, and to try to engage in risk mitigation. However, the downside of the existing risk assessment tools is that although they are "highly sensitive", they are not "specific" enough[9]. They detect far too many patients deemed to be at *high-risk* of experiencing future caries lesions who are not in actuality at high-risk. This is a critical point, because the ability to predict quickly and precisely who is actually at risk, is the main component of medical management of dental caries, that is not entirely possible today.

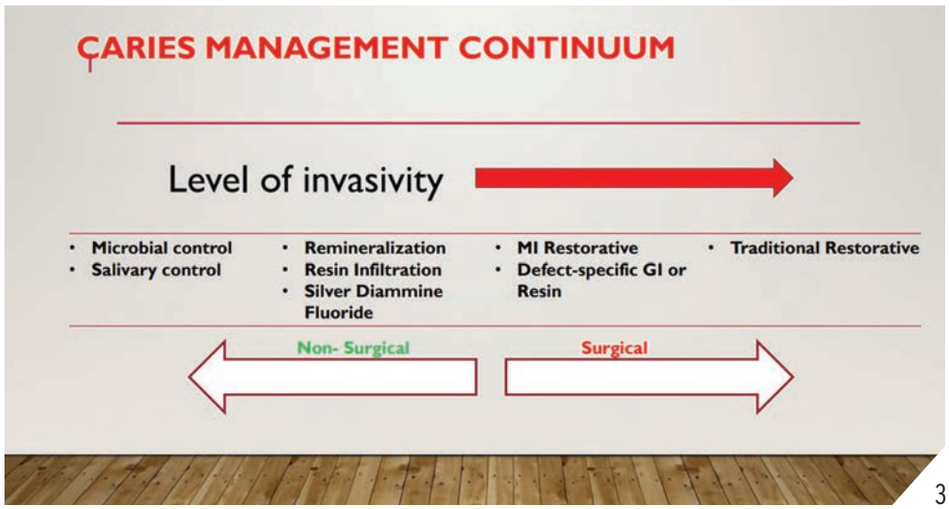
CARIES RISK SCANNING DEVICES

We look forward to the development of scanning devices which could more specifically and sensitively identify the future risk of caries lesions in both children and adults at an early stage. Technology-based tools assessment tools with specific outcome metrics related to likely "cavity experience in the future" could become validated determinants of risk. These devices might examine the "potential acid production" of a patient when challenged with sucrose, in order to describe the individual patient's biofilm, and could serve as a predictor of future cavity experience[10]. *(Fig. 3)* By having a technology that is shown to be predictive, one can deploy various "medical" or "pill doctor" treatments that would ultimately avoid restorative dentistry. *(Fig. 4)*

TREATMENTS THAT ARE MEDICAL ("PILL DOCTOR")

Such medical treatments include the use of silver diamine fluoride or fluoride itself[11-14]. Another discussed "medical" treatment that does not require surgical intervention is resin infiltration. We should be discussing saliva much more often and its impact on caries prevention and management. The fact that we talk little about saliva and its importance in caries prevention and management has impaired our ability to do more medical management, merely by monitoring the patient's saliva flow and consistency. We could look at viscosity of the saliva at each examination appointment as well as the estimated salivary volume. One can characterize these two aspects of saliva and determine if there has been a change.

There is "plain old fluoride" which if applied to early caries lesions that were identified with evolving technologies might halt the progression of these lesions, with technology assisted demonstrable results.[15-17] Indeed, it is clear that many have attempted to develop peptides and other molecules which could mitigate acid production or turn



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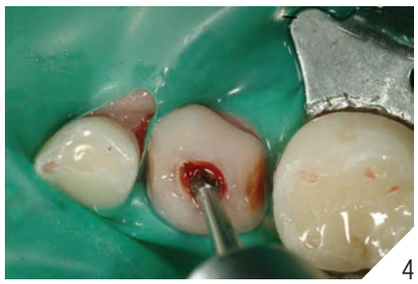
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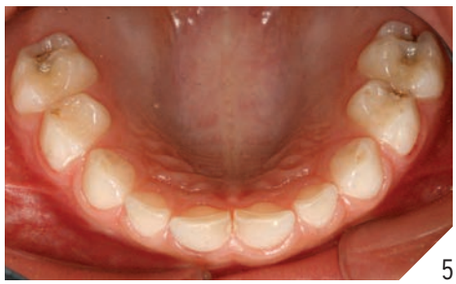
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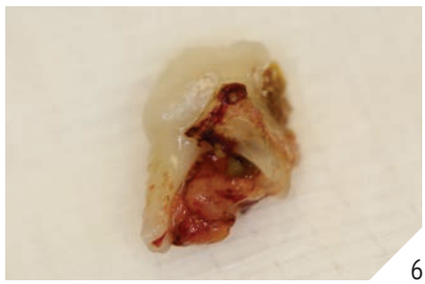
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3. Caries management continuum. **4.** Pulp therapy in primary teeth is a late-stage technique. **5.** Earlier-stage caries management. **6.** Very late-stage caries management.

off acid production by interfering with the chemical communication pathways within the biofilm. Such interventions might take place in various form of pharmaceuticals, such as those which currently disrupt human biochemical pathways. With the rapid pace of technology development in the applications of well-established molecular biological techniques applied to the oral biofilm, it is this author's opinion that we will soon be in an era where we can actually treat biofilms medically, based on their potential for inducing large amounts of caries lesions.

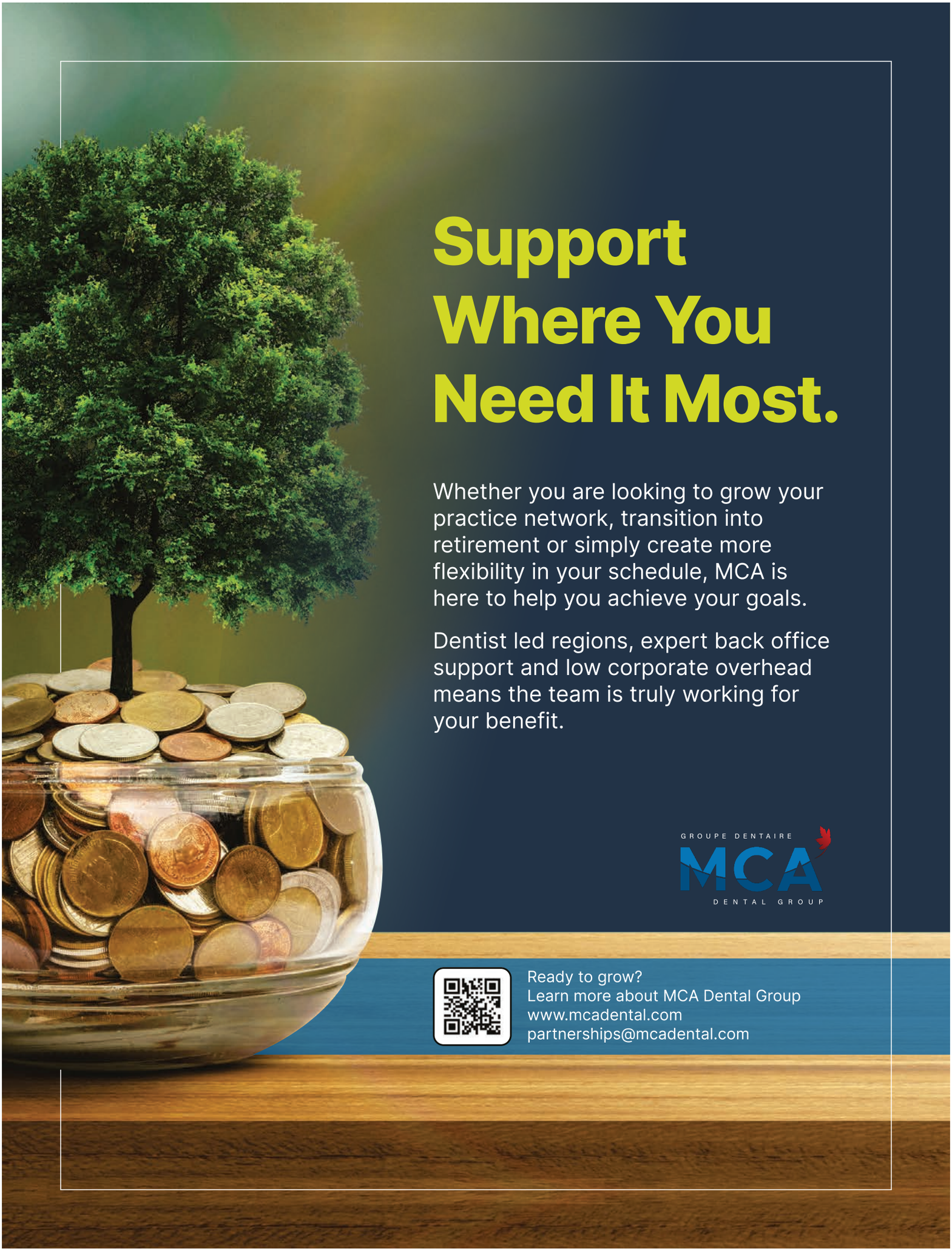
OTHER FORMS OF CARIES TREATMENTS

In addition to fluoride and other pharmacological agents that might be developed once we can establish/visualize demineralization in the early stages of the caries lesion process, we can also begin to use a variety of naturally occurring minerals which might halt or slow the progress of early caries lesions. This will bring great value to the medical management of dental caries.

DISCUSSION AND CONCLUSIONS:

Most of what we do in dentistry is related to restorative dentistry. Most endodontics, most prosthodontics and most of general dentistry practice is related to the late stages of caries activity *(Figs. 5 & 6)* that were not detected at a very early stage. With the cost of restorative dentistry being a major part of all dental expenditures, we can imagine the possibilities by implementation of medical management into the dental profession. This will precisely require attention to caries risk with a "metric" in the same way that metrics have allowed us to manage common chronic diseases such as diabetes, where HgA1C is a predictive metric. Therefore, it is the belief that technologies which can specifically assess both the risk and the progression of caries lesions in early stage will guide us into a host of pathways to treat caries lesions medically. It is distinctly possible that dentistry could evolve from an only surgical management of disease to a medical model of managing disease as the Flexner Report did for Medicine in the early 20th century.[18]

In a recent publication in Nature International Journal of Oral Science, Cheng et al[19] describe that "Dental Caries is a kind of chronic oral disease that greatly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threatens human beings' health." They further state that "a system of caries prevention and management is established based on dental caries diagnosis and classification".

As far back as 1994 and perhaps even earlier, another leading expert, Edelstein,[20] described the need to have medical management of dental caries. He was right then, as others were before him, yet his vision preceded the science and technology to support his recommendations. That has all changed.

Oral Health welcomes this original article.

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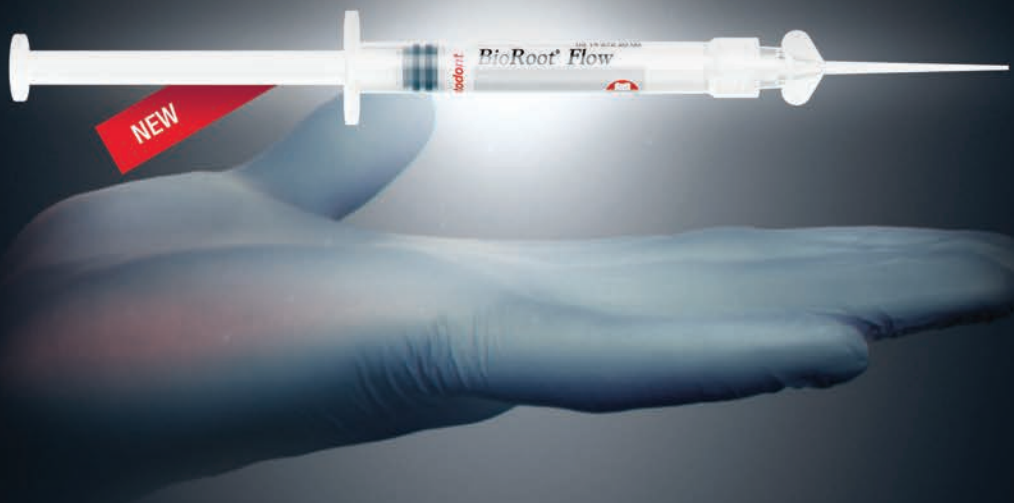

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Geoffrey Knight, BDSc, MSc, MBA, PhD

AMAZING TECHNOLOGY

The medical management of gangrene during the American Civil War was to amputate a limb above the infection site to prevent ongoing bacterial proliferation into the surrounding tissues. *(Fig. 1)*

During a lecture in 2000, Dr Graham Mount, a pioneer in the clinical use of glass ionomer cement, described dentistry as "the only health care profession that still treats an infectious disease by amputation."

In the last few years, dental technology has made significant advances to facilitate the diagnosis and replacement of tooth structure by either partial or complete amputation of teeth.

Sadly, all this amazing technology remains based upon the principles of the medical management of infectious diseases practiced over 150 years ago. This is especially unfortunate when there are so many more conservative treatment options currently available.

THE MEDICAL MANAGEMENT OF INFECTION

Dental caries is a bacterial infection of tooth structure caused by changing circumstances within the oral environment. There are defence mechanisms in the dentin pulp complex, that are capable of slowing or reversing the rate of caries proliferation.

Arrested caries are an example of how, in a favourable oral environment, teeth are able to remineralize caries infected dentine. *(Fig. 2)*

As the collagen matrix within the dentin has been denatured by the carious process, normal dentin is unable to form, and remineralization occurs by the deposition of mineral salts from the dentinal tubules and saliva. The dark colour of arrested caries is due to the inclusion of sulphur ions into the remineralizing tissues.

Arrested caries can be compared to scar tissue, where the dermis is unable to reform, so a protective layer of scar tissue (arrested caries) is laid down to cover the wound area to prevent bacterial incursion into the tissues beneath.

THE MEDICAL MANAGEMENT OF CARIES

The current medical management of a dermal infection is to:

- Clean the wound.
- Place a medicament to enhance the natural healing process.
- Isolate the infected site from a hostile environment and enable the healing process to occur.

These same principles can be applied to the management of dental caries.

CLEAN THE WOUND

Carious dentin contains a high degree of surface bioload consisting of bacterial plaque and other debris present within the mouth. Infected surface dentin may be so badly broken down that it splits away from the surface of the caries.

Within the carious dentinal tubules, necrotic debris and bacteria are present that can interfere with the healing process.

Surface preparation consists of removing badly broken-down infected dentin and the bioload from the surface of the caries and into the infected dentinal tubules.

Broken down infected dentin can be removed with a small excavator, gently levering it from the surface of the caries.

Bioload can be efficiently removed, to facilitate penetration of medicaments from the surface of the caries and into the dentinal tubules, by the application of 37% phosphoric acid for 15 seconds, washing with water and gently air drying. Polyacrylic acid will not remove bioload from the dentinal tubules. *(Fig. 3)*

APPLY A MEDICAMENT TO ENHANCE HEALING (REMINERALIZATION).

Fluoride release from glass ionomer cement has a limited effect in arresting caries and has been used extensively for caries management in remote communities (**A**traumatic **R**estorative **T**reatment), however GIC cannot be relied upon for total caries manage-

Geoff Knight is a general dentist from Melbourne, Australia. He is an internationally recognized dental speaker with a focus on preservation dentistry and has published a book on this topic: SILVER FLUORIDE AND GLASS IONOMER CEMENT: A SMART Operative Guide for Working with Teeth. The book presents evidence-based research for applying the current medical model to restorative dentistry with restorative procedures described in depth for each clinical situation.


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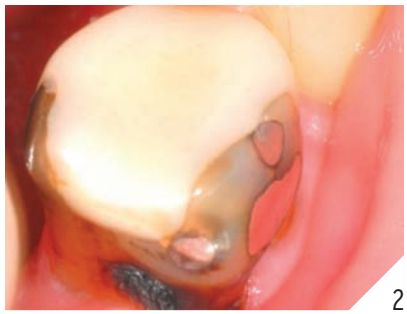
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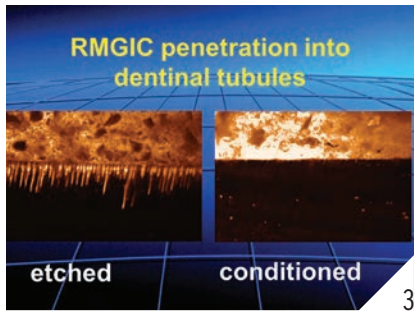

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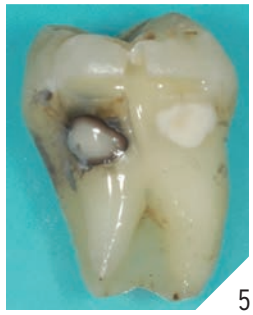
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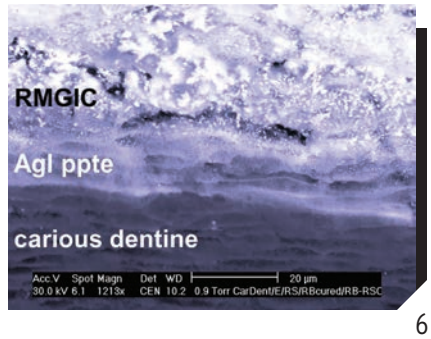

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1. 170 years ago, the medical model for treating gangrene was to amputate a limb above the infection. **2.** Arrested caries demonstrates a tooth's ability to remineralize caries into dental scar tissue. **3.** This demonstrates how effective etching is at removing necrotic tissue and bioload from non vital dentinal tubules enhancing both the penetration of medicaments and RMGIC as shown. Poly acrylic acid conditioning does not. **4.** Shows the bactericidal effect of AgI deposited on the surface of carious dentin after SDF/KI treatment. **5.** Demonstrates the effectiveness of SDF/KI in preventing staining compared to SDF alone. **6.** The application of SDF/KI to carious dentin increases the bond strength between caries and resin modified GIC.

ment and requires additional pharmacological assistance to be truly effective.

Ozone gas has been used as an effective caries management tool, but its use is limited due to the lack of an efficient delivery system.

Fluoride varnish application has been shown to have limited clinical benefit.

Silver fluoride compounds are highly bactericidal and have long been used to arrest caries; silver nitrate has been used since the early 1900s, and silver diamine fluoride was identified from Japanese literature for arresting caries in the early 1970s. *Fig. 4* shows the bactericidal effects of AgI deposits on a carious dentin surface.

Aqueous silver fluoride (AgF) and silver diamine fluoride (SDF) both effectively arrest dental caries. However, the side effect of staining the arrested caries black has generally limited their use for the management of caries in deciduous teeth and root caries.

Staining by AgF and SDF can largely be prevented by the immediate application of potassium iodide (KI) that scavenges any remaining free silver ions to form silver iodide, a creamy coloured white precipitate. *Fig. 5* shows the difference in staining of a GIC restoration when one cavity was treated with SDF and the other with SDF/KI.

The application of potassium iodide during pregnancy or patients with thyroid issues should be done in consultation with an appropriate medical practitioner.

ISOLATE THE INFECTION FROM THE ENVIRONMENT TO IMPROVE HEALING (REMINERALIZATION)

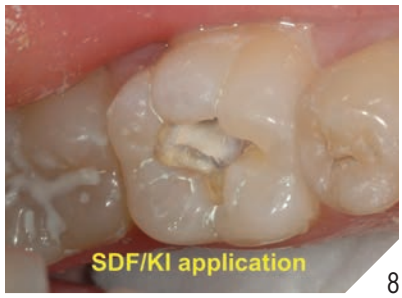
Composite resin is a popular material for the replacement of lost tooth structure and is an excellent restorative material for cavities caused by a lost restoration without residual caries or tooth loss caused by trauma.

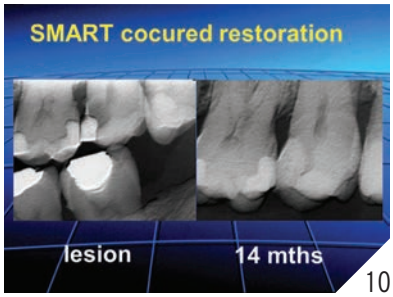
Composite resin relies upon the bond of resin based dental adhesives that adhere poorly to caries affected and infected dentin. In order to repair a carious lesion with composite resin, all remaining caries must be removed prior to bonding onto sound dentin, and this requires the removal of a lot of remineralized tissue. ***In essence, composite resin is unsuitable as a restorative material to restore carious teeth.***

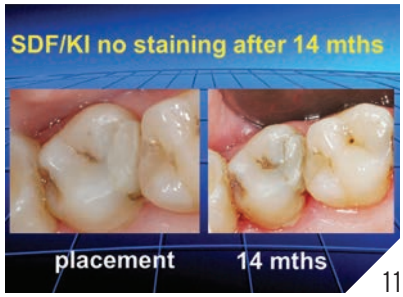
Glass ionomer cement has a weak chemical bond to sound and carious enamel and dentin. As the interface between a tooth and glass ionomer cement is stress free, high bond strengths are not required. Furthermore, prior application of SDF and AgF enhances the bond strength of GICs to enamel and dentin. *(Fig. 6)*

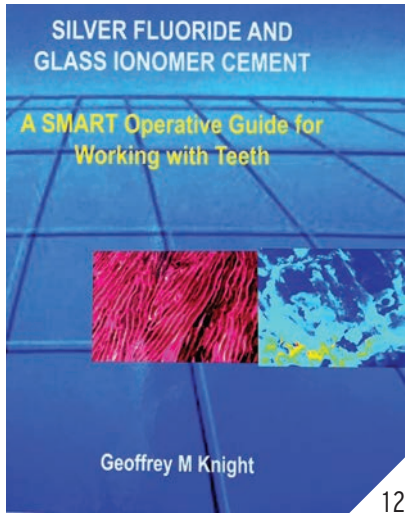
High strength GICs are indicated for single surface restorations where there are no unsupported cusps present. These include occlusal surfaces, proximal surfaces using tunnel or slot preparations and lesions at the gingival margins.

- *Figures 7 to 9* show a clinical restorative procedure using the medical model of caries management:
- *Figure 7:* A cavity is prepared for a









7. An occlusal cavity preparation with supported cusps for the restoration of caries prior to SDF/KI and a GIC overlay. **8.** Following a 15 second etch, the caries has been treated with SDF and KI. Notice the white precipitate of AgI on the caries surface. **9.** A wear resistant GIC restoration provides a simple and predictable solution for the management of single surface caries. **10.** Large asymptomatic caries on multiple surface cavities shows the healing (remineralizing) ability of a SMART GIC, composite resin sandwich restoration. **11.** A large multi surface SMART restoration treated with SDF/KI eliminates staining at the cavo margins. **12.** Author's book which presents evidence-based research for applying the current medical model to restorative dentistry with appropriate restorative procedures described in depth for each clinical situation. QR code opens the author's book web site on Amazon.

silver fluoride treated restoration, leaving significant caries in situ.

- *Figure 8:* Shows the cavity following a 15 second etch and SDF/KI placement. Notice the white precipitate of AgI on the surface of the carious dentin.
- *Figure 9:* Shows the completed restoration.

Multi surface restorations require the extra strength of a composite resin overlay over the GIC base, or a conservatively prepared indirect restoration.

In summary, single surface restorations to remineralize caries are placed as follows:

- Remove excessive bioload with a small excavator
- Etch for 15 seconds, wash, and dry the preparation
- Apply one or two drops of SDF or AgF onto the caries, avoiding gingival tissues.
- Immediately apply KI until the white precipitate becomes clear
- Wash away reactant and air dry
- Place a GIC restoration.

The placement of a multiple surface restoration follows the same steps using a Resin modified GIC (RMGIC) instead of auto cure GIC, as a base or liner, prior to placing a composite resin or indirect restoration overlay.

Figure 10 shows the remineralization ability of SDF/KI on an asymptomatic carious lesion14 months after placement and *Figure 11* shows how the use of SDF/KI prevented SDF staining of the restoration over that time.

OPPORTUNITIES

In many ways the dental profession is at a crossroads.

The delivery of high-tech treatment offers patients choices that would otherwise be unavailable to them. Unfortunately, such procedures are often highly invasive, time-based treatments that do not provide permanent solutions to patient needs and have cost constraints that limit their availability. Furthermore, the enthusiasm amongst the dental profession to adopt these technologies can lead to over

diagnosis and prescription of their use.

Within this mix of the treatment options available to dentists, there are clinical situations to treat carious teeth, that would be better managed by using a more conservative medical based model of care.

Medical caries management is based upon the treatment protocols of Atraumatic Restorative Treatment (ART) that has been successfully used to treat caries in both established and emerging economies for a number of years. The enhancement of ART by the application of silver-based medicaments creates the interesting acronym; Silver Modified ART or SMART.

SMART is a treatment model of care that:

- Enables high quality and predictable dental restorations over a wide range of platforms in established and emerging economies
- Provides a virtually pain free and relaxed environment for both patients and dentists that encourages the super efficient delivery of care.
- Dramatically reduces the need for general anaesthetics for asymptomatic and apprehensive children
- Lays the ground for future minimally invasive management of dental caries

By leaving caries in situ, SMART enables the predictable, efficient and stress-free delivery of restorative care with benefits to both patients and clinicians and can be readily accessible on a global scale.

In reality, the coexistence of SMART and high-tech dentistry offers patients the very best of care across a wide range of treatment modalities and lays the foundations for the successful evolution of the profession.

Oral Health welcomes this original article.

AD INDEX

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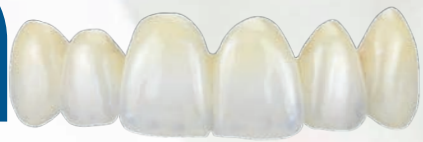

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PROACTIVE INTERVENTION DENTISTRY

Why we need a resin QR code when choosing a resin for longevity and clinical effectiveness

Peter Walford, DDS, FCARDP

When we complete a resin restoration, we hope that it will last, be attractive, wear well, retain its polish, maintain shade, reject extrinsic stain, and not fracture *(Figs. 2 & 3)* Resins today number in the hundreds. While most are clearly superior to the handful available at the beginning of the adhesive era, we remain substantially in the dark about how to choose among them.

Eventually, as clinicians, we distill a daily suite of resins from this field of hundreds, choosing, for practical reasons, only a small subset. Our simplest clinical portfolio often entails a posterior resin with high flexural strength and masking capacity, and an anterior resin with lower strength but better blending capacity and higher gloss. *(Fig. 4)* To this, most practitioners add a flowable with good handling and high radiopacity.

A bulk fill may round out the resin armamentarium, or a dual-cure (DC) flowable/bulk fill for light-starved applications such as deep proximal boxes, post-luting, small core buildups, crown repair, and interim treatment.

A small spectrum of shades in these resins completes our suite, workhorses we rely on from pedodontic *(Fig. 5)* to senior cases, from the smallest simple interventions to grand Herodontic restorations *(Fig. 3)* and full mouth restorations. *(Fig. 6)*

Hundreds of other resins are omitted from our palette.

Where do we obtain the information to make this cull? In the Age of Data, it seems an irony that when reaching for resins, we do not have comparative data at our fingertips. There are dental journals that publish valuable data, but nowhere is it comprehensive.[1,2,3]

Twenty years ago, this author compiled a spreadsheet of 40 composite parameters for 40 resins from copious correspondence to manufacturers, as a basis for recommendations to study club members. This involved 1600 potential data points, a very laborious task, which is now obsolete, because those resins have been superseded. The work on today's offerings remains undone. For everyday practice, what rational basis is readily available to guide one's final selections from the resin lottery?

Factually, we do know that resins differ widely in their parameters. For example, flexural strength varies as much as 400%, polymerization contraction 250%, particle size 1000%, elastic modulus (also called flexural modulus) 700%. Cure remains invisible but a lack of curability can be a serious drawback as seen when comparing two similar resins. *(Tables 1 & 2).*

Clearly, with such a spread of variables, much might be gained by fully understanding the dimensions of the resin one is using. From clinical experience, practitioners can anecdotally tie outcomes to these parameters. But that is not science. True scientific method is founded on objective measurement. Sadly, correlations with measured values and clinical performance have not been a research focus.

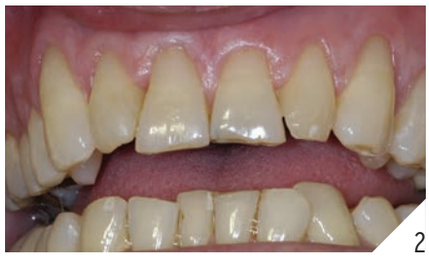
Within each resin formulation, these 40 parameters, measurable and distinct, are under a manufacturer's control. From a trial sample we can assess external factors: handling, esthetics, opacity, polish, and ease of finishing. However, the deeper aspects of formulation can only be guessed at. "Try it Doctor, you will love it…" is offered at point of sale.

The clinical questions are, "Which parameters matter the most and what do they predict?"

As a long-term study club mentor, I am routinely asked what resin I use. My summary opinion is: "The best posterior results are obtained using a resin with a **flexural strength** exceeding 150 MPa (from a 3-Point test, not a 4-point test), a **flexural modulus** approaching or exceeding average dentin (10 to 12 GPa), with a **curability** under 20 Joules, a **finish** exceeding 95 Gloss Units (95% of incident light is reflected back to the human eye), over 80% **filled by weight**, with a **largest particle size** under 30 microns, less than 2% **polymerization contraction**, high molecular weight polymer, low-slump, adaptable viscosity, lack of stickiness when heated, shade stability, free from extrinsic stain acquisition

Peter Walford is a longtime mentor of live and virtual study clubs in composite technique and adhesive prosthodontics. He practices on a gulf island in British Columbia, builds racing sailboats, and operates a small organic farm with his wife. pwalford@telus.net


1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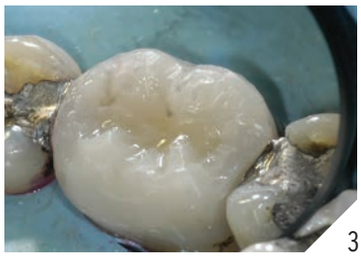
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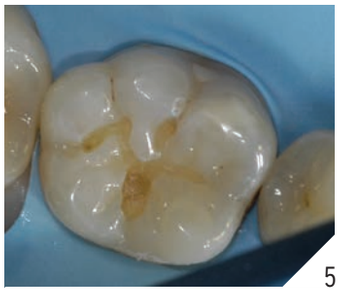
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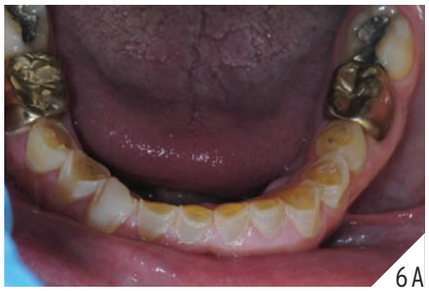
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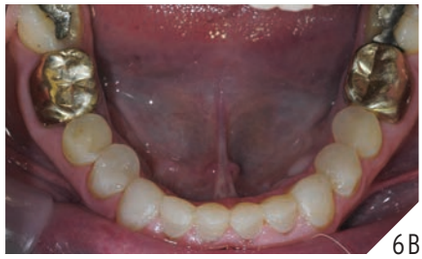
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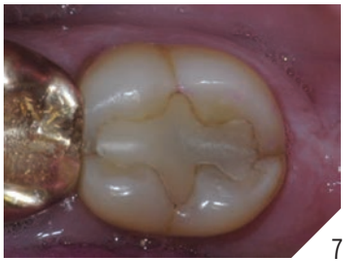
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1. Typical QR Code. **2.** Class V abrasion restorations after 15 years. **3.** Herodontic MODBL restoration. **4.** Typical operatory resins in heater; opaque posterior resin, blending anterior resin, and flowable. **5.** Fissurotomy preparation where heated low viscosity paste resin outperforms flowables. **6A.** Acid reflux erosion. **6B.** Resin rehabilitations after five year remission. Correct resin selection is critical to success. **7.** Failing composite with surface roughness, marginal stain, loss of anatomy, and chipping cavosurface.

or intrinsic shade change, and higher than medium opacity to hide sclerotic or amalgam-stained dentin."

I am aware that perhaps half of this short-list of variables may be unavailable to most dental practitioners and incomprehensible to many even if it was.

Try to imagine how our practices could be different if a "Resin QR Code" *(Fig. 1)* accompanied each product, and a matching App was available for its interpretation. It would provide a measuring stick to inform practitioners, in advance of trial or purchase, the composition of each resin.

Consider this: manufacturers know these factors, why can't we know them too? Their product, which is brought to market, is what they consider their best blend of interactive properties. But are they best for the clinical treatment we have at hand? Are there weaknesses we need to compensate for in clinical placement? If we acquire greater depth of understanding, dialing in the properties to the clinical need, can we reliably expand our successful range of resin dentistry?

A universe of trial and error, blind product loyalty, and mysterious outcomes could be swept away, along with the painful process of maintaining credibility while explaining to a patient why treatment is failing. *(Fig. 7)*

BREAKING DOWN THE VARIABLES

Resin properties can be organized into two categories:

1. Those that can be perceived by the operator
2. Those that cannot

1: VISIBLE PROPERTIES

Essentially visible factors, accessible through use, include:

ESTHETIC PROPERTIES

- Shade fidelity at placement: is A3 actually A3?
- Blending/translucency – also called "metamerism" *(Fig. 8)*
- Opacity to hide dark tooth structure *(Fig. 9)*
- Extrinsic stain acquisition
- Polishability gloss (GU) as a percent of reflected incident light after

CURING TIME FOR GINGIVAL WALL INCREMENT

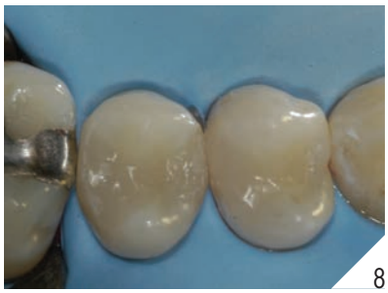
Cure time (seconds)	Cure % (gingival compared to occlusal)
20	60
40	92*

Table 1: Popular resin with excellent gingival photoconversion (From Reality Publishing).
* Exceeds 80% goal.

CURING TIME FOR GINGIVAL WALL INCREMENT

Cure time (seconds)	Cure % (gingival compared to occlusal)
20	N/A
40	59

Table 2: Popular Resin with inadequate gingival photoconversion (From Reality Publishing).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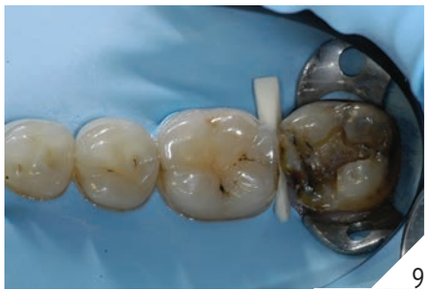
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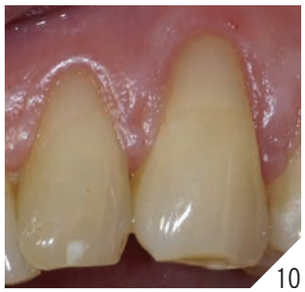
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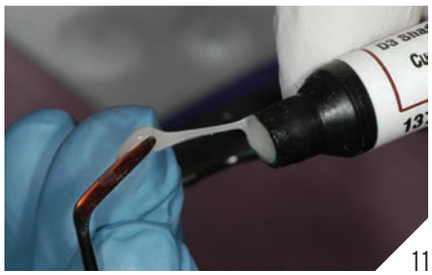
8. Unstained dentin permits a transparent resin. **9.** Stained dentin requiring masking with an opaque resin. **10.** 5-micron particle resin with excellent tissue acceptance. **11.** Resin with high plasticity after heating.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polish (100=mylar,50= matte) relevant to appearance and to Class V tissue acceptance *(Fig. 10)*
- Fluorescence

HANDLING PROPERTIES

- Viscosity = firmness/softness to condensation
- Tendency to cohere vs granulate in placement
- Stickiness/pullback to placement instruments
- Response to chairside heating *(Fig. 11)*
- Slump
- Tack
- Thickness of oxygen inhibited layer

FINISHING PROPERTIES

- Tendency to dull finishing carbides: an overhead cost factor when burs dull too quickly
- Tendency to "load" or clog burs

2: INVISIBLE PROPERTIES

Invisible factors are far more numerous than the preceding and are critical for clinical durability. These are available only as data and cannot be perceived with human eyes and hands.

- Flexural strength: while dentin lies between 200-250MPa; resins are 100-187. The numbers in this range represents an industry standard, derived from a 3-point test. A 4-point test exists but delivers a different numerical value
  - o This drives suitability for light/medium/heavy functional load, and survival of marginal ridges (author's opinion=AO) from 45 years of practice and study
- Compressive strength. Almost all resins exceed 350 MPa, including most flowables. Amalgam lies between 350-500MPa. Therefore, not clinically discriminatory (AO)
- Flexibility: elastic or flexural modulus in GPa: dentin is 12-16, enamel is 80. Paste resins are usually 9GPa or higher, flowables are generally 4 to 9 GPa
  - o High modulus, 9-18 GPa are suitable for posterior application (AO)
  - o Low modulus, 5 to 9 GPa, indicates suitability for abfractions (AO)
- Polymerization contraction, ranging from
  - o Under 2% in the best paste resins
  - o Over 5% in flowables. Contraction interfaces with flexural

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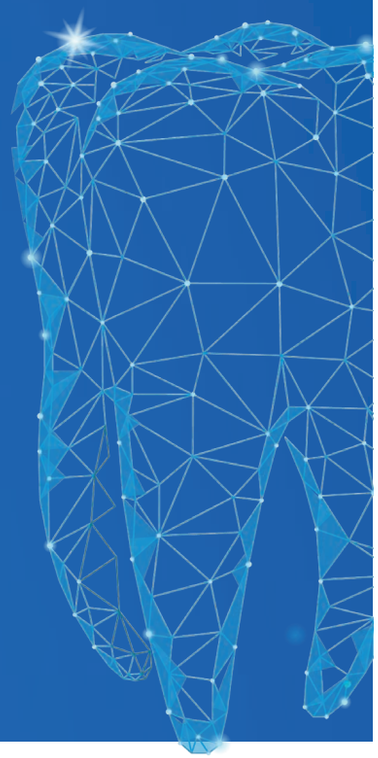

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- All indirect restorations:
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- Desensitization/Sealing of Tooth
- Intraoral Repairs:
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Versatility: ALL etching techniques

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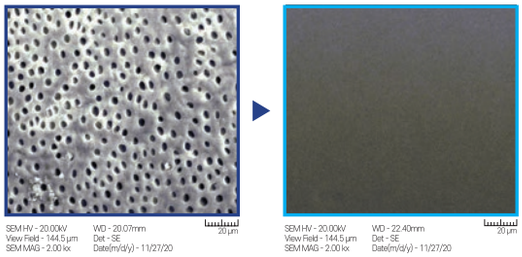

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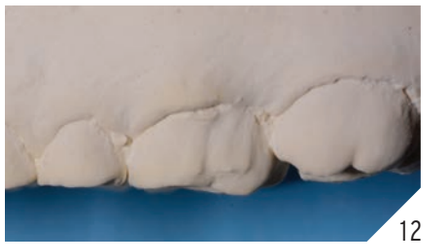
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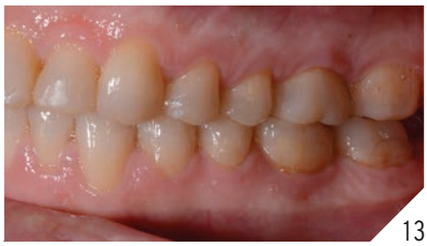
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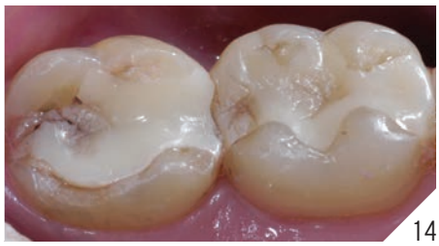
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12. Posterior crown damage and shortening of cuspid from bruxism. **13.** Post-op full mouth composite rehabilitation. Few resins are both cosmetic and have the capacity for these loads. **14.** "Crow's feet", showing resin intolerance to centric contact point-loading.

modulus to predict post-operative crazing and white line formation (AO)
- Creep
- Hardness , reported in three different scales; Barcol, Knoop, and Brinell
- Wear = microns per year, average; enamel is 15-25. Average wear is only revealed through clinical trial research or laboratory testing through accelerated aging protocols
- Wear is critical to the durability of a full mouth composite reconstruction of a bruxing patient/ *(Figs. 12 & 13)*
- Abrasiveness against denture teeth, which correlates with largest particle size (AO)
- Point load tolerance. Relevent to occlusions with sharp cuspal morphology(AO). *(Fig. 14)*
- Thermal expansion: the closer to tooth structure, the better, to reduce cyclic strain to bond interface
- Radiopacity: as mm. of aluminum equivalent. Commonly understood
- Resin molecular weight. Higher is better (AO)
- Water absorption. Less is better (AO)
- Solubility: clearly, we wish our restorative materials to be as insoluble as possible, not only to avoid their dissolution but also to avoid transport of constituents into the human body
- Durability to chemical attack, for example from alcohol, ketones and other organic food constituents
- Biocompatibility of organic compounds
    - o Allergenicity
    - o Mutagenicity[4]
    - o Apoptosis, a measure of decreased intracellular respiration, for example, only available through studies of immortal cell cultures[4]
- Particle loading by weight and volume
    - o Largest particle
    - o Smallest particle
    - o Plucking resistance
    - o Particle surface coating and particle fillers (silica, zirconium, barium glass, yrbettium trifluoride, etc. This information guides the need for primers in composite repairs.
    - o Biocompatibility of fillers as an occupational exposure and patient health factor
- Microbubble inclusions at manufacture; this may vary from 0.5% to over 2%. This is much higher than what one would expect and differs widely from product to product[5.]
- Curability for each shade, expressed as Joule requirement to 80% at the gingival floor, usually based on hardness, relative to 100% at the occlusal surface *(Table 1 & Table 2)*
    - o Catalyst system for each shade
    - o Optimal curing wavelength
    - o Rapidity of cure at recommended exposure. Gradual polymerization may be better for some applications, and may relate to crazing of thin residual tooth structure if flexural modulus is high (AO)
    - o Depth of cure, in mm. at recommended exposure
    - o Distance limit for curing tip-to- resin photopolymerization. This guides the need to resort to Dual Cure (DC) or Self-Cure (SC) resins in deeper proximal boxes, for example
- Polymerization contraction. Initial and subsequent after 5 seconds, 10 seconds, and 5 minutes. Manufacturers can quote values from early-stage contraction to gain market advantage *(Table 3)*
- Extent of cure of DC materials in DC mode alone and not light cured after placement.

3: SHELF LIFE

Finally, for effective practice management and overhead control we need to be aware of product deterioration, such as:
- Degradation variables, such as catalyst expiry if refrigerated or not
- Absorption of atmospheric moisture
- Deterioration from chairside heating

These factors form a pyramid of measurable variables that have a bearing on the likelihood of clinical success, such as Class II fracture in a patient who bruxes (relating to flexural strength (AO)), or Class V enamel margin survival in a clencher who abfracts his/her CEJs (relating to flexural modulus (AO)).

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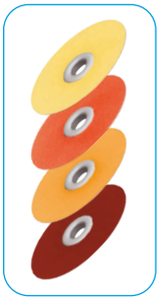

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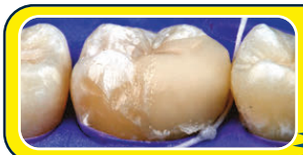

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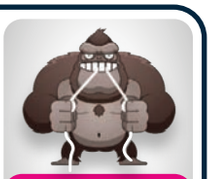

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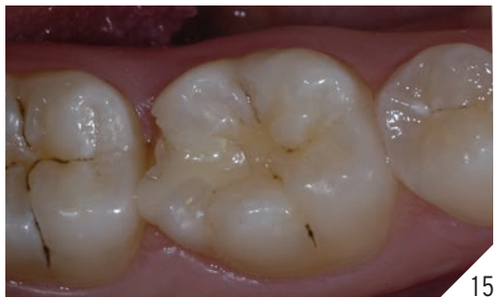
VOLUMETRIC SHRINKAGE (%)

Measured at light-cured times	%
5 seconds	0.9
10 seconds	1.4
5 minutes after end of curing (40 sec)	2.3

Table 3. Typical volumetric shrinkage increasing post-operatively (From Reality Publishing).



15

15. Reverse-engineering fractured marginal ridge in a non-bruxing patient: Undercure? Insufficient proximal volume? Pinpoint proximal contact? Or weak resin?

resin masterpiece (curability, adaptability, voids and flexural strength). They determine difficulty of placement, feasible increment size, ease of finishing, ultimate gloss, blend or opacity of shade, speed of placement, and ultimately patient satisfaction, and practice profitability. They enlighten reverse-engineering composite failures: breakage, premature wear, lost color fidelity, poor polish. With data we may judge if it was initial resin inadequacy or was it improper placement. *(Fig. 15)?*

RESEARCH COMBINED WITH PARAMETERS WILL PREDICT CLINICAL OUTCOMES:

Until we have data, the profession cannot research relevance to clinical outcomes. These correlations are neither clear nor consensual. Take the case of two clinically similar resins; one has a flexural strength of 110 MPa, the second 220 MPa? What applications require the higher flexural strength? Conversely, what does high compressive strength predict when it so similar to amalgam?

What is the relationship to overall resin technique? Can superior resins forgive flawed restorations such as pinpoint contacts and high occlusion? Can benign contraction overcome white line due to improper margin design in preparation? Will a resin with an exceptionally low wear rate still provide a satisfactory clinical service life if poorly cured and thin? Will high flexural strength override failure to remove stress risers created by sharp internal form? Does resin heating or the lack thereof determine if resins deliver as well clinically as under laboratory conditions?

Currently, answers to these sorts of questions are the anecdotal outcome of clinical experience.

ISSUING A CHALLENGE TO THE PROFESSION:

Frankly, at the moment we suffer profession-wide design deficiencies. We don't have the data, we don't know what to predict if we did have it, and preparations are not standardized.

The definitive textbook of composite method has yet to be written. We are trained by dental faculties who develop an in-house consensus. This is by no means standard across the continent, either in form or in instrumentation. Even so

fundamental a factor as preparation design differs widely between universities. We train in isolated domains.

Historical principles from the stolid universe of GV Black methodology have morphed into a fluid continuum of dissimilar adhesive concepts. Preparation design has become dependent on where we trained and where we practice, not a universal basis.

This quasi-scientific approach achieves no standard of care, a major problem when regulatory bodies need to re-train practitioners whose composite resin outcomes are the subject of complaints. Profession-wide surveys continue to indicate problems, such as reported in Clinicians Report in June 2018, highlighting recurrent decay seen by 43% of clinicians within 2 years of resin placement.[1] A repeat survey, four years later, in February 2022[1] similarly found that wear, fracture and recurrent caries were frequently seen. Four years have gone by, no progress. We must admit that all is not well in the composite resin world.

We require a better roadmap through the largely invisible world of resins, both for the individual practitioner and for the profession. At the moment, we listen to sales reps, consult with a colleague down the hall, read a review of 5 good points in a resin's formulation, overlook the other 35 parameters, and then proceed by trial and error. Everything composite resin that fails obviously needed a crown, not a better resin or a better engineered preparation design and more appropriate resin.

We need to pull up our collective bootstraps; a framework akin to a QR code with an accompanying interpretive App is needed to intelligently guide our resin selection.

Without data, clinical research cannot establish correlations to clinical outcomes. Without baseline correlations, science cannot be brought to bear on preparation design.

The public wants to believe we are capable of sound, credible, and reproducible treatment, meeting a defined standard of care. Taking control of the Wild West of resins is a critical first step. From this we will derive the ability to correlate clinical outcomes. Then and only then can we rationalize, test, and standardize preparation forms.

There is hard and detailed work ahead if we wish to bring science to resin treatment and optimum service to patients. QR Code, Gentlemen, Please Start Your Engines. OH

Oral Health welcomes this original article.

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Dental implant failure and the association with proton pump inhibitors (PPIs) and selective serotonin reuptake inhibitors (SSRIs)

Zeeshan Sheikh Dip.Dh, BDS, MSc, PhD, M.Perio, FRCDC; Aditya Patel DDS, MPerio, FRCDC; Eraldo Batista DDS, MSc (Perio), DSc (Oral Bio), FRCDC

INTRODUCTION

Dental implant placement and implant-supported rehabilitations are highly successful treatment options, and more implants are being placed recently by general dental practitioners and specialists than ever before.[1] For dental implant treatment to be successful, it is imperative to have a firm and stable osseointegration. Where, osseointegration is defined as the direct structural and functional connection at the interface between bone tissue and the dental implant surface.[2] Therefore, bone formation, remodeling and metabolism plays a crucial role in the success of osseointegration.[2,3] Aberrant bone metabolism has been shown to have a negative impact on osseointegration which can result in implant failure.[3] Implant failures can be classified as either early failure, which occur before the prosthesis is placed, and late failures, which are associated with functional loading following placement of the prosthesis.[4] Early failures frequently occur because of a disruption during the initial healing phase post-implantation, leading to impaired bone-to-implant contact and the subsequent failure of osseointegration;5 the onset of late failures may be related to multiple variables such as peri-implantitis,[6] systemic factors,[7,8] overloading,[9] and/or parafunctional habits.[7,9,10]

Bone metabolism is thought to be affected by several factors thus interfering with the quality of osseointegration.[3] The prevalence of systemic diseases and the related intake of medications has increased as the population ages. The intake of medications prescribed for some systemic diseases and conditions could potentially modulate bone metabolism and negatively influence implant-related outcomes with an increased risk of breakdown of the peri-implant tissues.[11] Here we briefly discuss two such medications which are the Proton pump inhibitors (PPIs) and Selective serotonin reuptake inhibitors (SSRIs), and bring to the notice of our peers their potential association with dental implant failures.

Proton pump inhibitors (PPIs) are a group of drugs that are rapidly becoming the third most prescribed pharmaceutical products worldwide.[12] PPIs are very effective in both prevention and treatment of gastrointestinal acid related conditions, such as peptic ulceration, gastroesophageal reflux disease (GERD or GORD), dyspepsia, helicobacter pylori infections, stress gastritis and eosinophilic esophagitis.[13] PPIs irreversibly inhibit the proton pump in the acid-secreting parietal cells of the stomach and thereby suppress the gastric acidity.[14] PPIs supress gastric acidity by inhibiting the functions of the proton pump (H1/K1 ATPase),[14] which can also be found in bone tissue.[15] The proton pump inhibition of the osteoclasts can decrease their activities and PPIs also impair calcium uptake through the intestines.[16]

Several observational studies have shown an association between the use of PPIs and high risk of bone loss and bone fractures.[17] Also, animal studies have shown that PPIs administration in vivo can impair bone healing and implant osseointegration [18]. Within the evidence available, systematic reviews have showed an association of PPIs with an increased dental implant failure.[19] There is an increase in patients that have had successfully osseointegrated dental implant that have been in function and are failing after they are prescribed PPIs *(Fig. 1)*. Despite the known negative effects of PPIs on the skeleton, the effect of these drugs has yet not been thoroughly explored in many important bone-related clinical conditions including osseointegrated dental implants. Many patients undergoing implant therapy are already taking PPIs without much thought given to their potential effect on osseointegrated/osseointegrating dental implants.

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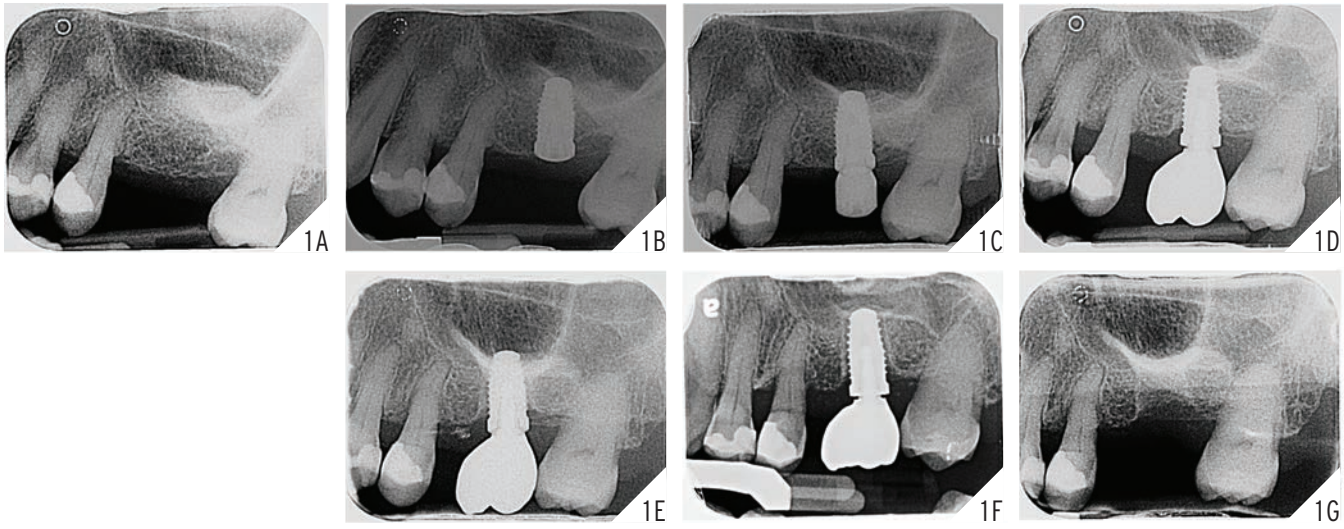
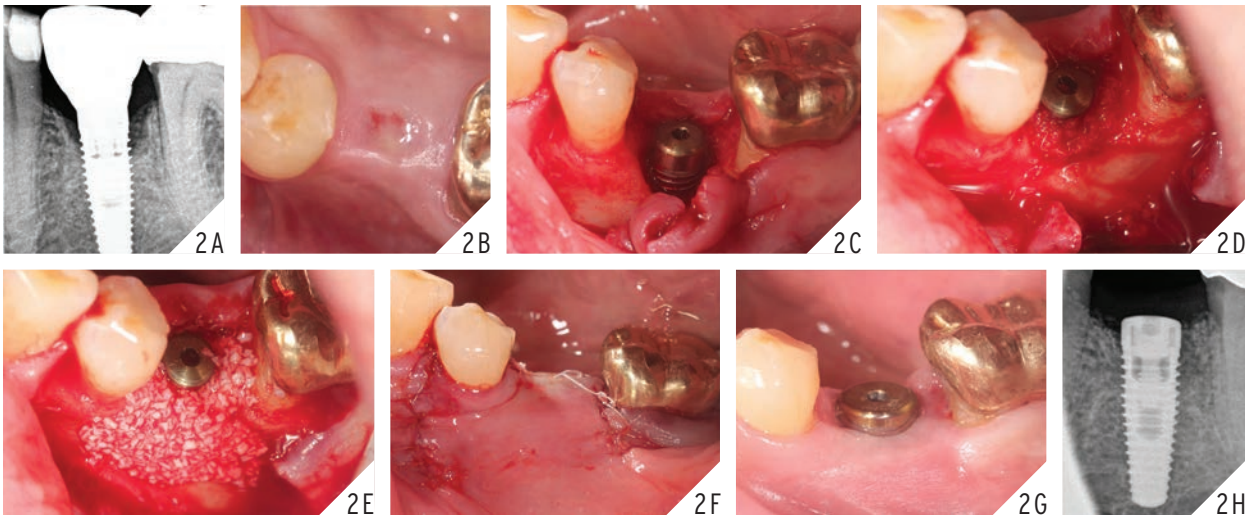


1A. Sinus lift procedure performed for #2.6 implant site preparation for a 55-year-old female patient (August 2016). **1B.** Implant placed at #2.6 site (March 2017). **1C.** Implant stage II procedure performed (June 2017). **1D.** Implant #2.6 restored (November 2017). **1E.** Follow-up appointment and continued maintenance therapy with no issues (November 2018). In 2019, the patient had a flare up of Irritable-Bowel-Syndrome (IBS) and was prescribed Pentaprazole (PPI) and Pinaverium Bromide. **1F.** The implant was loose and there was loss of osseointegration (March 2021). **1G.** The implant was lost as it fell out (April 2022)



2A. A Pre-operative radiograph of a 57-year-old male patient, non-smoker, with non-contributory medical history, presenting with a circumferential bone defect around an implant #3.5 that had been loaded for 2 years. The patient was placed on Escitalopram (SSRI) 20 mg/day, one year after the implant was loaded. **2B.** The crown was removed, and a healing screw was placed until partial soft tissue coverage was achieved. Suppuration was evident upon compression. **2C.** Upon full thickness flap elevation and thorough debridement of the defect, angular bone loss pattern is observed around the implant. **2D.** The implant surface was rubbed with a cotton pellet soaked in 0.12% chlorhexidine for 1 minute, followed by thorough rinsing with sterile saline. A contour approach was used to regenerate the bone defect; first, autogenous bone chips were harvested from a nearby area and packed within the defect. **2E.** The autogenous bone chips were overlaid with deproteinized bovine bone matrix (DBBM) xenograft, and a non-crosslinked collagen membrane was placed over the implant. **2F.** The flap was sutured in order to attain complete, passive coverage of the implant. **2G.** The implant was exposed at seven months; good quality of the soft tissues is seen, despite less-than-ideal plaque control in the adjacent dentition. 3 mm of keratinized tissue was preserved on the buccal aspect with no bleeding on probing or suppuration around the implant. **2H.** Seven-month post-operative radiograph prior to crown placement showing complete resolution of the bone defect.

Selective serotonin reuptake inhibitors (SSRIs) are prescribed for the treatment and/or management of depressive, or anxiety conditions. We are seeing a major increase in patients taking these medications. There is evidence which points towards an association of SSRIs with increased dental implant failure rate [19]. We see in our clinical practice more and more patients who have been placed on SSRI therapy after the implants have been loaded a few years back and are now demonstrating peri-implant bone loss *(Fig. 2)*. Recent evidence suggests that SSRIs have been identified in playing a pivotal role on the osteoblast/osteoclast balance. Serotonin can regulate osteoclast activation and differentiation as osteoclasts derive from hematopoietic cell precursors.[20] Furthermore, SSRIs have been shown to produce a detrimental effect on bone mineral density and trabecular microarchitecture through their anti-anabolic skeletal effects.[21] Noteworthy, adding to the effect on osteoclast activation, SSRIs may increase osteoclast differentiation and reduce osteogenic differentiation and mineralization, which may also negatively impact implant osseointegration. Recently, a preclinical in vivo study has elucidated the effect of SSRIs on osteoblast differentiation and bone regeneration in rats.[22] SSRI medication significantly reduced osteogenic differentiation and mineralization with concomitant reduction of osteoblast marker genes (including alkaline phosphatase, Osterix, and osteocalcin), indicating its putative impact on the regulation of bone metabolism.[22] Such cellular findings are in concordance with the results obtained by Wu et al. (2014), who demonstrated that patients taking SSRIs experienced an increased risk of dental implant failure.[23]

Recent evidence and findings from systematic reviews show an association of PPIs and SSRIs with increased implant failure.[19] The effect of these medications requires further investigation in future studies as potential confounders for implant outcomes. A comprehensive evaluation and understanding of the patient's medical background and the medication-specific side effects on bone metabolism, is necessary in assessing the patient's risk of implant complications when considering dental implant therapy. We suggest discussing this with the patient during the treatment planning stage and being mindful of these implants having a reduced success rate. OH

Oral Health welcomes this original article.

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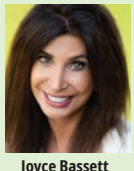

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Oral probiotics: A window to novel therapeutic possibilities for gum disease

Abdelahhad Barbour, BSc-Hons, MSc, PhD; Tabasom Kambakhsh DDS student; Michael Glogauer, DDS., PhD, Dip. Perio

Host-associated bacteria exist on a continuum, from commensals with low virulence and beneficial properties to disease-causing pathogens whose colonization can be deadly.[1] As microbiomes evolve, their metabolites, interspecies interactions, and the host immune compartment can cause changes to the bacterial niche that facilitate the outgrowth of microorganisms associated with a dysbiotic state; this, in turn, can favor colonization with an infectious agent, stimulate the production of virulence factors, or exacerbate dysfunctional immune or metabolic states in the host to promote disease.[2] Commensal organisms provide protection from pathogenic species in several ways, including colonization resistance, stimulation of the host immune response, and interbacterial chemical warfare.[3,4]

The human oral microbiome is a dynamic and diverse ecological niche which colonizes distinct microenvironments, including the hard surfaces of the teeth as well as epithelial surfaces of the mucosa.[5] The ability of oral microbiota to self-assemble into site-specific biofilms mediates oral microbiome-host interactions and can produce different innate immune responses depending on the specific bacterial stimuli. For example, the overgrowth of subgingival bacteria, such as those associated with periodontitis, can induce dysbiosis and inflammation. The inflammation activates the systemic immune response through neutrophil priming in circulation.[6] On the other hand, oral bacteria have been detected in distant body sites, including the intestine,[7] lungs,[8] heart,[9] and brain.[10] This necessitates the development of novel therapeutics to prevent the overgrowth of disease-associated bacteria in the oral cavity to limit the dissemination and initiation of distal diseases.

EXAMPLES OF CORRELATION BETWEEN ORAL BACTERIA AND SYSTEMIC DISEASES

Oral microbes alone are not able to initiate systemic diseases, and this is evident from the fact that oral microbiota translocation (from the oral cavity into distal body sites) occurs even in healthy individuals. However, additional factors such as underlying genetic susceptibility or existing prosthetics or other tissue damage are needed to create an environment where translocated oral microbes can potentiate diseases at distal locations . Below are some examples of the correlation between oral bacteria and systemic diseases.

Alzheimer's disease: P. gingivalis, the keystone pathogen in chronic periodontitis, and its toxic protease gingipain was identified in the brains of Alzheimer patients.[11]

Ventilator-associated pneumonia (VAP): Dorsal surface of the tongue serves as a potential reservoir for bacterial species involved in VAP, including *H. influenzae, S. pneumoniae.*[12]

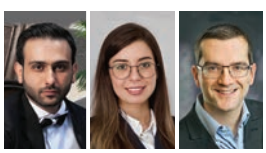
Infectious endocarditis: Fetal systemic infections can occur when oral bacteria enter the bloodstream and settle in the heart lining, a heart valve, or a blood vessel. This typically has occurred in the presence of dental infection and is associated with a dental procedure in patients with prosthetic heart valves or a history of previous endocarditis.[13]

Diabetes: There is a complex interaction between diabetes, inflammation, the oral microbiome, and periodontal disease. Diabetes causes a shift in oral bacterial composition, making it more pathogenic.[14]

Colon cancer: The oral microbe *Fusobacterium nucleatum* is implicated in triggering distal disease and is among the most prevalent bacterial species associated with colorectal cancer. *F. nucleatum* has been suggested to potentiate intestinal tumorigenesis and modulate the tumour-immune micro-environment.[15]

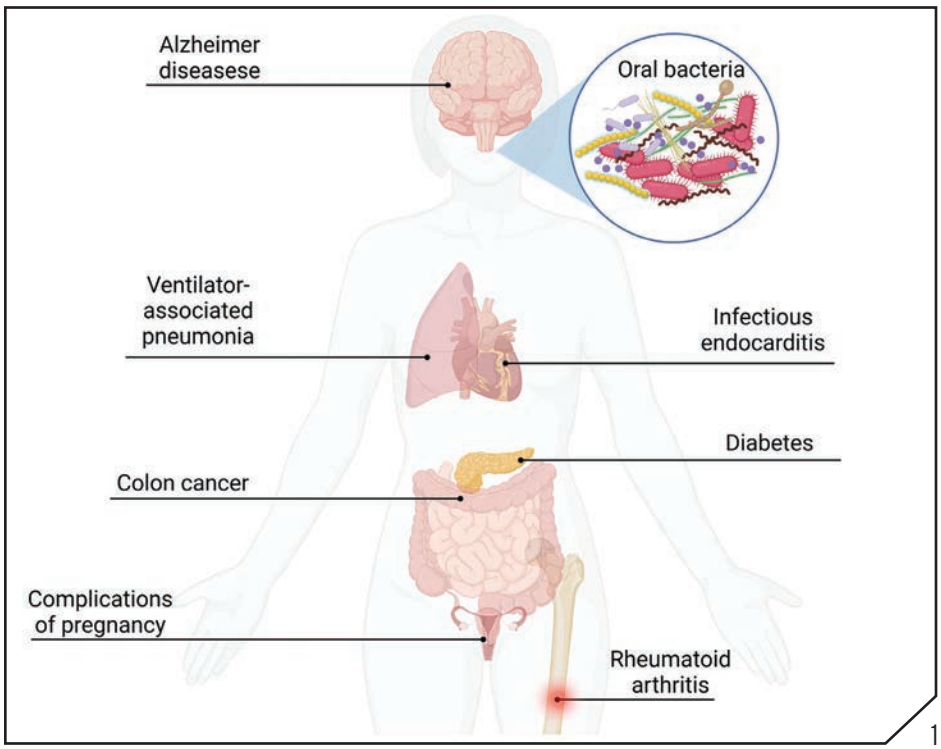
Complications of pregnancy: A growing body of evidence supports the link between the composition of the oral microbiome and adverse pregnancy outcomes such as preterm birth, preeclampsia, low birth weight and others.[16]

Rheumatoid arthritis (RA): *P. gingivalis and Aggregatibacter actinomycetemcomitans* (Aa) have been linked to RA pathogenesis through induction of changes in neutrophil function including hypercitrullination of host proteins.[17]



Abdelahhad Barbour is a renowned molecular microbiologist in the field of oral probiotics development, antimicrobial peptides and host-microbe interactions. He is the co-founder and director of Ostia Sciences Inc, a biotech company focused on microbiomes and probiotics developments. **Abasom Kambakhsh** has completed 3 years of undergraduate studies at UofT and has now joined the faculty of dentistry as a dental student. **Michael Glogauer** is an internationally recognized clinician-scientist and leader in the fields of neutrophil biology, innate immunity, oral microbiome, and periodontology. He is Professor at UofT, Dentistry and head of dental oncology at University Health Network.

Links between the oral microbiome and systemic diseases.



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PERIODONTAL DISEASES: PERIODONTITIS AND GINGIVITIS

Periodontal Disease (PD) refers to a wide array of diseases of the gingiva and periodontium. Gingivitis is one such disease that starts in response to the bacteria found in dental plaque. Dental plaque is a biofilm of bacteria usually found on the enamel of the teeth and gums. Gingivitis results from localized inflammation in response to plaque-residing bacteria. If gingivitis is not diagnosed and treated, it can progress to chronic periodontitis. In this disease, inflammation chronically affects the host both locally and systemically. While causing alveolar bone loss and periodontal pocket development locally, the inflammation in periodontitis can also contribute to worsening systemic diseases such as diabetes, Alzheimer's disease, and atherosclerosis.

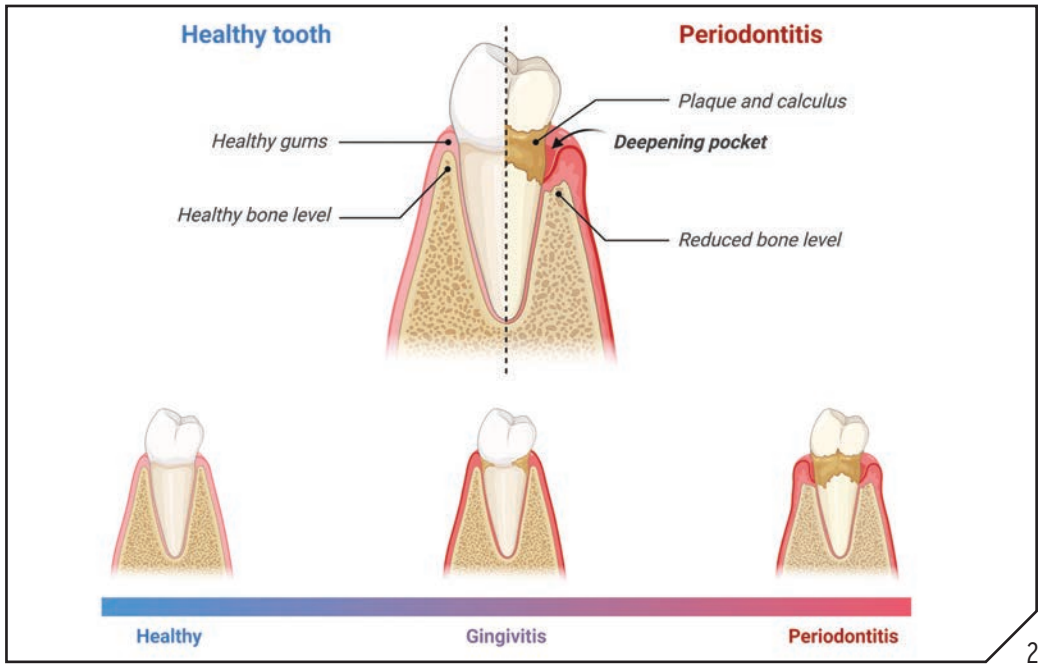
There are numerous risk factors for the development of periodontal diseases. These risk factors can be grouped into modifiable and non-modifiable factors. For example, smoking cigarettes is a modifiable risk factor for periodontal diseases. However, genetic factors belong to the non-modifiable risk factor group.

Periodontal disease diagnoses usually occur through clinical methods such as clinical attachment level, bleeding on probing, probing depth and radiographic findings. However, these diagnostic methods factors such as bleeding on probing depend on the force applied and also rely on damage which has occurred during previous disease activity. Sczepanik et al. (2020) suggested that hyperactivated neutrophils are more prone to producing reactive oxygen species and proteases, leading to greater susceptibility in patients to developing periodontal disease.[18] Reactive oxygen species are considered a "double-edged sword". That is because they are beneficial for killing pathogenic bacteria by neutrophils, but their overproduction could be detrimental to the host itself through the damage they do to host proteins.

In order to develop more accurate and less intensive methods for diagnosing and screening periodontal diseases, researchers looked into oral neutrophil levels. Neutrophils, also known as Polymorphonuclear Neutrophils (PMNs), are the primary cells driving the inflammatory response observed in periodontal diseases. As cells of the innate immune system, the levels of these cells were suspected of changing upon disease development in the same way that blood levels of white blood cells are used to indicate a possible infection within the patient.

Our group and other researchers have been looking into whether quantifying the oral neutrophil levels would (a) correlate with periodontal disease stages and (b) be an accurate biomarker for painless

Development of gingivitis and periodontistis along with changes to the alveolar bone density and gingival pocket development.



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screening for periodontal diseases and monitoring its progression.

To address the first concern, we counted the neutrophil levels in rinse samples collected from healthy subjects and patients suffering from gingivitis and chronic periodontitis, whose disease stages were assessed through periodontal examinations. Based on results, we found that oral neutrophil counts correlated with the severity of periodontal diseases.[19] This showed that the oral neutrophil counts provided accurate measures of the oral inflammatory load and correlated with periodontal disease severity. Furthermore, it is shown in the literature that neutrophils could be excellent biomarkers of oral health. A substantial body of research supports the idea that oral neutrophil counts could be used as screening biomarkers for periodontal diseases.[20]

ORAL PROBIOTICS

Bacteriotherapy refers to changing microbiomes towards a healthy composition to prevent and treat diseases. More precisely, bacteriotherapy would introduce beneficial bacteria, probiotics, to the targeted microbiome to overwhelm the pathogens.[21] Probiotics by definition are "live microorganisms that, when administered in adequate amounts, confer a health benefit to the host".[22] Conventional probiotics are generally of intestinal origin, including species related to lactobacillus and Bifidobacterium genera, with the principal application to provide relief for disorders of the Gastrointestinal (GI) tract. Oral and upper respiratory tract diseases can not be prevented or treated with GI probiotics mainly since Lactobacilli and Bifidobacteria do not persist within the oral cavity. Hence, a more efficient strategy is to use oral microbes isolated from their natural oral habitat in healthy humans as oral probiotics.[23]

STREPTOCOCCUS SALIVARIUS AS AN ORAL PROBIOTIC

One of the earliest bacterial colonizers of the oral cavity is *S. salivarius*,[24] which secretes antimicrobial peptides (AMPs) called salivaricins to interfere with the growth of oral and upper-respiratory tract pathogens. In recently invited high-impact publications, our group provided expert opinions regarding the importance of salivaricins and other bacterial metabolites as novel compounds to fight antibiotic resistance and oral diseases.[2,25] Specific strains of *S. salivarius* that can recolonize the oral cavity and secrete anti-perio-pathogens metabolites would represent ideal candidates for oral probiotic development.

Additionally, while the produced salivaricins are expected to interfere with periodontal pathogens such as *P. gingivalis*, little is known about their other roles in the oral cavity, including re-shaping the dental biofilm and communicating with innate immunity. There are two examples of *S. salivarius* strains that are commercialized and available as oral probiotics; their produced salivaricins only target selected disease-associated

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bacteria mainly associated with halitosis[26,27] and bacterial strep throat.[28] There is no clear evidence that the available oral probiotics are adequate to prevent major oral diseases like dental caries[29] and periodontal disease since their in vitro interference with the growth of dental caries- and periodontitis-associated bacteria is not fully established.[30] This would require a continuous hunt for novel *S. salivarius* or other oral commensal strains that can interfere with multispecies pathogenic biofilms.

ORAL PROBIOTICS FOR PERSONALIZED DENTAL CARE?

Developing oral commensals as specific oral probiotics will enable personalized dental bacteriotherapy, including different bacterial strains that secrete narrow spectrum AMPs that target specific oral pathogens without disturbing the indigenous composition of health-promoting microbes in the oral cavity. Next-generation sequencing enables dentists to identify their patients' disease risk factors based on microbiome analysis data obtained from oral specimens, including dental plaque, saliva, and tongue swabs. Intervention with specific probiotics can help to repopulate the oral cavity with billions of beneficial bacteria that can suppress pathogens and promote a healthy and balanced oral microbiome. Our research group at the University of Toronto has identified a unique oral commensal bacterium, under development, as a future oral probiotic that can inhibit periodontal pathogens and communicate with innate immunity to reduce inflammation. More work is needed with close collaboration between clinicians, microbiologists, bioinformaticians and probiotics developers to make more beneficial oral probiotics available in the near future.

Oral Health welcomes this original article.

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Beyond Osseointegration: Improving Implant Success and Preservation

Dr. Siavash Hassanpour
H.B.Sc., M.Sc., D.D.S., M.Sc. (Perio)., FRCD(C)

Dental implants are a key tool in the dental armamentarium for the replacement of missing teeth. In the absence of surgical contraindications, major patient risk factors and financial limitations, dental implants are the preferred treatment modality for the replacement of missing teeth. This is evidenced by the 8-fold increase in the prevalence of implant dentistry in North America between 1999 and 2016 and a conversative projected 4-fold increase by 2026.[1] That said, implants are not a panacea and are subject to esthetic, biomechanical and biological complications.[2] Peri-implant diseases (peri-implant mucositis and peri-implantitis) are the most common biological complications seen in implant dentistry. The goal of this article is to explore a team approach aimed at minimizing the risk of biologic implant complications. There will be a special emphasis on patient-centred, pro-active approaches to implant maintenance and complete oral homecare routine.

Achieving and Maintaining Osseointegration

The cornerstone of implant dentistry is the process of osseointegration, which was defined by Branemark in 1985 "as the direct structural and functional connection between living bone and the surface of an implant without intervening fibrous tissue."[3] Osseointegration allows for the rigid fixation of oral dental implants to the jaw bones thus supporting the overlying prosthetic superstructure. Achieving osseointegration is reliable and predictable. This is demonstrated by the low incidence (1-2%) of early implant failure, defined as the loss of implant integration prior to the establishment of a prosthetic connection and loading.[4] Maintaining osseointegration, however, is more difficult. While high rates of implant survival and success **(>90%)** can be expected, unfortunately implant complications and failures are also commonly reported in long-term follow-up studies.[5] While implant failures can be described as esthetic failures (e.g., mispositioned implants) or biomechanical failures (e.g., implant fractures), the focus of this article will be on biological failures or peri-implant diseases.

Peri-implant diseases (Figure 1) are defined as either peri-implant mucositis or peri-implantitis. Peri-implant mucositis is characterized by bleeding on gentle probing, peri-implant gingival erythema and swelling (with or without suppuration), and in an increase in peri-implant probing depth. It is important to note that an increase in probing depth is caused by gingival swelling and decrease in probing resistance as opposed to peri-implant bone loss. Peri-implantitis shares many of the clinical features of peri-implant mucositis such as bleeding on probing, gingival erythema, and swelling (with or without suppuration) and an increase in peri-implant probing depth. **However, the defining feature of peri-implantitis is progressive and often rapid peri-implant bone loss**.[6] If undetected or left untreated, peri-implantitis can result in implant failure or loss, which can in turn have significant financial consequences for the patient and clinician.

Figure 1. Biological Implant Complications

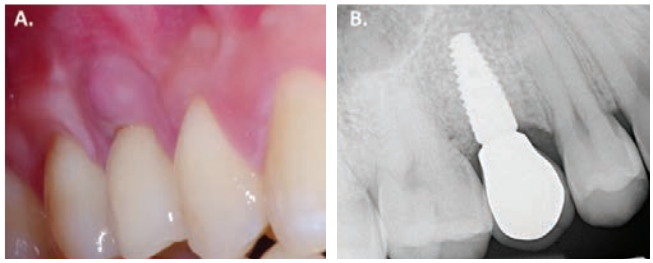
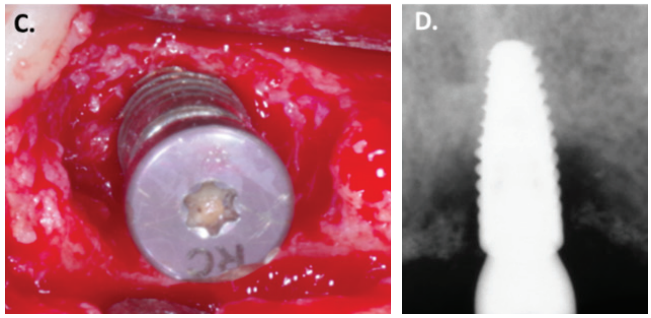


Fig 1. Peri-implant mucositis (Fig 1A., 1B.) is characterized by bleeding on probing, gingival erythema and swelling, and in an increase in peri-implant probing depth in the absence of peri-implant bone loss.



(Fig 1C., 1D.) Peri-implantitis shares the clinical features of peri-implant mucositis as well as peri implant bone loss.

A Team Approach to Avoiding Peri-Implant Diseases and Increasing Implant Success

Longevity of dental implants is influenced by multiple factors including implant-related factors, surgical-related factors, restorative/prosthetic-related factors, patient-related risk factors and implant maintenance-related factors—see Table 1.[7,8] All members of the dental team including the surgeon, restorative dentist, dental lab, dental hygienist and most importantly the patient, must be aware of their respective roles and be an active participant in the prevention of biological implant complications.

Table 1. Factors That Contribute to Peri-Implant Disease[7,8]

Risk Factors for Developing Peri-Implant Disease	
Implant Design	• Smooth (machined) implants • Non-platform switched implants
Patient	• Smoking • Periodontitis • Poor oral hygiene • Uncontrolled diabetes
Surgical	• Poor bone quality • Inadequate bone volume • Lack of attached keratinized tissues • Mispositioned implant
Restorative	• Excess cement • Poor emergence profile • Heavy occlusal forces • Open contracts • Excess food impaction
Maintenance	• Irregular dental maintenance • Non-compliant patient • Improper instrumentation of the implant • Lack of homecare

A Team Approach: Dental Surgeon

The dental surgeon is responsible for completing a pre-surgical medical and dental history of the patient to identify major patient risk factors as related to implant complications.[9] The surgeon must examine the surgical site clinically and radiographically to account for all anatomic restrictions and limitations and to ensure the site is well suited for implant placement. Ideally, soft tissue and bony deficiencies should be corrected prior to implant placement. The surgeon and the restorative dentist should collaborate on a prosthetically driven implant treatment plan. The surgeon should then make every reasonable effort to optimally place an appropriate implant in an ideal position as dictated by the prosthetic plan. This process is best achieved using guided implant surgical techniques to minimize positional errors at the time of implant placement. The surgeon must then confirm osseointegration and stability of the implant before transferring the case to the restorative dentist.

A Team Approach: Restorative Dentist

The restorative dentist (in partnership with a dental lab) is responsible for ensuring the prosthesis is well designed and can meet the patient's esthetic and functional needs. When possible, implants should be restored with a retrievable, screw-retained prosthesis as excess cement is a well-known risk factor for peri-implant disease.[10] If the implant prosthesis must be cement-retained, care should be taken to avoid extrusion of excess cement sub-gingivally. The occlusal forces on the implant prosthesis should be light with little to no excursive forces and the proximal contacts should be tight and cleansable. Heavy occlusal forces and parafunctional habits should be identified and controlled to avoid biomechanical complications such as prosthetic screw loosening or fractures. Clinical and radiographic parameters must be recorded at the time of implant restoration to serve as a baseline for detection of future peri-implant disease.

A Team Approach: Dentist/Dental Hygienist

The dentist and/or dental hygienist must have a full understanding of the case definition of peri-implant mucositis and peri-implantitis to be able to recognize early signs of peri-implant disease. At each recall, the patient's medical and dental history should be updated followed by a complete clinical and periodontal examination. The examination should include assessment of plaque control, bleeding on probing, peri-implant probing depths, mobility of the implant superstructure or fixture, assessment of occlusal forces and proximal contacts. Radiographs are not required at each recall unless there is clinical evidence suggestive of progressive peri-implant disease. Any notable changes when compared to the baseline should be noted and addressed immediately. There is strong evidence identifying plaque as a key etiological factor for the development of peri-implant mucositis and peri-implantitis[6] (Figure 2).

Careful implant debridement is required at each recall visit using an implant safe instrument that does not damage or increase the surface roughness of the implant/abutment.[7] Patients must be educated about the importance of routine professional recalls and plaque control, and an emphasis should be made on peri-implant disease prevention as treatment of peri-implant diseases (particularly advanced peri-implantitis) is often unpredictable and costly.[11]

Fig 2. Plaque/Biofilm is a key Etiological factor for the development of peri-implant diseases.

Involve, Educate, Equip, Succeed: An Evidence-based Approach to Patient Homecare

Implant dentistry is not an exact science and there will always be a risk for complications. However, these risks can be minimized when an experienced team of dental professionals work synergistically to plan, execute, and maintain an implant. That said, in the absence of patient participation, involvement and ownership of homecare, implant complications are inevitable (Figure 3).

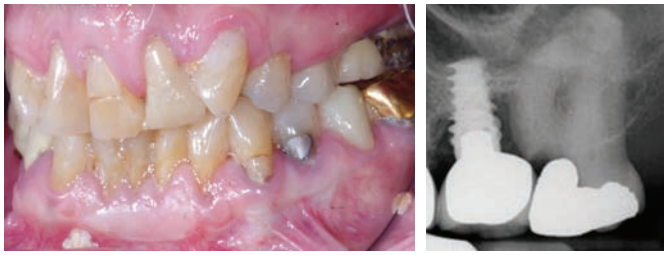


Fig 3. In the absence of patient involvement and ownership of homecare, implant complications are inevitable

The greatest service we can provide for our patients is to educate, motivate and empower them to become an active participant in the homecare and maintenance of their dental implants. The dental team must devise and recommend a personalized home-care regimen, backed by science, that provides patients with the tools and resources to effectively manage and maintain their dental implants. Patients often look to their trusted dental professionals to provide them with guidance on how to care for and maintain their teeth/implants. It is **our collective responsibility to ensure that we provide our patients with the appropriate tools** required to prevent plaque accumulation around dental implants in a safe and efficient manner.

Fig 4. Oral-B iO Targeted Clean brush head for implant maintenance.

Oscillating-rotating electric toothbrushes are effective in removing plaque around implants[12] and stabilized stannous fluoride (SnF_2) dentifrice has been shown to be both safe and biocompatible with titanium implants.[13] A 12-month clinical study of 80 peri-implant patients using an oscillating-rotation electric toothbrush has confirmed the efficacy of the electric toothbrush in improving peri-implant clinical parameters when compared to manual brushes. More importantly, the oscillating-rotation electric toothbrush had no deleterious effects on the peri-implant soft tissues and was met with high patient compliance.[13]

Fig 5. A home-care regimen, backed by science, plays a key role in implant success and preservation.

SnF_2 dentifrices also have the distinct advantage of having antibacterial properties in addition to their anticariogenic properties. SnF_2 has been shown to reduce metabolic production of bacterial toxins, suppress pathogenic virulence and promote bacterial and host symbiosis in natural teeth.[14-16] Interproximal cleaning with traditional floss is recommended around implants but is often met with low compliance due to dexterity issues and lack of comfort. To overcome this challenge, interdental brushes and a water-flosser should be recommended to all implant patients. A water flosser can provide comfortable, targeted, aerobic irrigation of hard-to-reach interdental areas and areas prone to food impaction and is therefore a useful adjunct in the maintenance and home care of dental implants.

Conclusion

Dental implant therapy requires significant financial and time investments from the patient and the dental team. Implant complications are a serious and often expensive problem for the patient and the dental team. The incidence of implant complications can be reduced when the dental team works together to provide exceptional care while taking a pro-active approach in involving the patient in the care and maintenance of their dental implants.

Scan the QR Code to take The 2018 AAP/EFP Classification of Periodontal & Peri-implant Diseases CE Course worth 3 CE Credit Hours.

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PROACTIVE INTERVENTION DENTISTRY

Post Operative Pain Management during the Age of Opioid Crisis

Diana Bronstein DDS, MS,MS, MS; Jon B. Suzuki, DDS, PhD, MBA

INTRODUCTION

These are unprecedented times. The opioid crises strain our communities. The challenge for dental practitioners mirrors the need for new pathways. Being successful with patient treatment is imperative for all practicing dentists. Treatment success is determined by the outcome for the patient. Patients care primarily for levels of morbidity and only then for esthetics, function, and cost. Fear of pain during and after the procedure will deter a significant patient population from seeking dental care. Not until dental pain forces the patient to present as an emergency does the actual pain overcome the fear of pain.[1,2]

Post-operative pain (POP) in dental surgery is due to a surgical insult to the tissue and the subsequent inflammatory process.[22] Prostaglandins and other inflammatory mediators, sensitize peripheral nerve endings and produce electrophysiological polarization effecting pain sensation.[23] The initial insult causes a firing of fast speed myelinated A-delta fibers transmitting the pain signal to the central nervous system (CNS) for interpretation. Inflammatory pain then results from the activation of slow unmyelinated C-fibers and reaches its peak 48–72 h post-op.[22] Pain modulation is complex because pain signaling pathways are affected by patient-specific physiological and psychological factors. Gender, age, predisposition to feeling pain, anxiety levels, and pain expectations influence pain levels for patients and their sensitivity to pain.[24,25] Providers know from experience that patients' pain perceptions even to local anesthetic injection varies greatly. On the face of it, this may be surprising because the procedure of local anesthetic administration is standardized by the provider, the injection technique and the medium injected. This implies that dosing and non-pharmacological techniques may also need to be modulated for effective control of POP in some cases.[26]

This paper will discuss the specific indications for post-operative pain management in dentistry. Presentation of single and combination options for pain management will be discussed.

OVERVIEW AND DEFINITION OF CURRENT OPIOID CRISIS WITH HISTORICAL BACKGROUND

The American Association of Oral and Maxillofacial Surgeons (AAOMS) recognized in 2017 that opioids are routinely prescribed for postoperative pain.[19] They published the "White Paper on Opioid Prescribing: Acute and Postoperative Pain Management." In it they stated that nonsteroidal anti-inflammatory drugs (NSAIDs) and Acetaminophen (APAP), taken simultaneously, work synergistically to rival opioids in their analgesic effect," further recommending that opioids be reserved "only for acute, breakthrough pain".[20]

Due to its highly addictive properties the use of opioids for pain management has come under attack. The chief clinical concerns associated with the widespread opioid and narcotics abuse epidemic is physical dependence and addiction, as well as serious adverse effects.[27] While tolerance develops to the analgesic property of opioids, patients do not develop tolerance to their adverse effects. The prescriber may reduce the prescription dose to balance these unintended consequences, ultimately leading to inadequate analgesic effects.[28]

The American Dental Association recently announced a policy supporting statutory limits on opioid dosage and duration[29] as a response to the urgent opioid epidemic. This has helped to encourage prescription and recommendations of non-opioid analgesics when clinically appropriate. However, there are also risks associated with oral NSAIDs, which may cause prolonged bleeding and gastrointestinal upset[34,35,30] as they can impair platelet function and the coagulation cascade. NSAIDs are contraindicated for patients who have gastrointestinal ulcerations and/or erosive gastrointestinal diseases.[30] NSAIDs also increase the risk for thrombotic events, such as stroke and heart attack, and the risk of these vascu-

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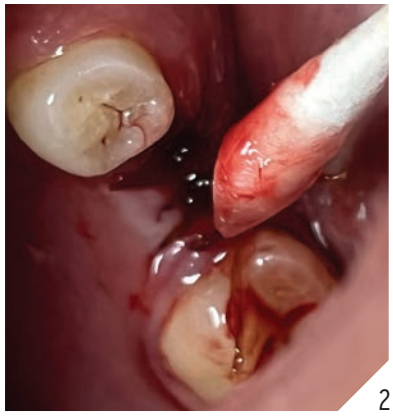
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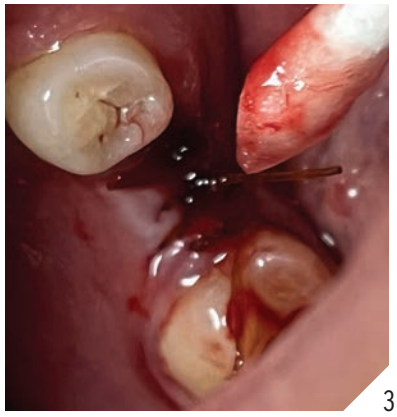
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1. StellaLife gel and spray for intraoral post op application. **2-3.** Intraoral post op application of StellaLife gel after extraction and flap closure by suturing with CGS (chromic gut sutures).

lar events increases with the duration of NSAID use;[30] NSAIDs should be used with caution in patients on blood pressure medications or with a history of cardiovascular disease.[31] Short term post operative use of up to 3 days may reduce adverse event occurrence. Post operative pain and swelling following oral surgery procedures typically subside following the third post-operative day,[32] so pain management is most critical for 3 days following surgery.

NSAIDs should be avoided in pregnant patients. Instead, Acetaminophen (APAP) alone is preferred, and brief treatment with opioid-APAP combinations may be considered.[36,37]

LITERATURE REVIEW OF AVAILABLE EVIDENCE-BASED PAIN MANAGEMENT OPTIONS AND PRESENTATION OF SELECTIVE PAPERS.

Practicing credible, clinically applicable, evidence-based dentistry is the objective. Translational, reliable, and reproducible applications leading to successful treatment outcomes is the goal. Before a professional implements a new procedure or change, the provider strives to ascertain whether this will result in improvement.[7]

Metanalysis reviews hold the highest level of evidence, yet most of them conclude correctly, that more research is needed. Expert opinion and clinical experience documented in case reports hold the lowest level of academic empiric evidence and are considered anecdotal.

In 2016, a study evaluating an OTC pain management protocol with NSAIDs, acetaminophen and StellaLife VEGA mouth rinse (stellalife.com) resulted in a three-fold reduction in opioid prescriptions.[13]

In another oral surgery study, antiseptic mouth rinses were compared in their post operative morbidity management and their cytotoxicity. The StellaLife VEGA rinse was found to be superior to chlorhexidine in efficacy and pain reduction as well as healing properties.[17]

Starting in June 2020, the largest oral surgery division at the US Navy Recruit Training Command implemented a standardized non-opioid postoperative pain regimen for all dentoalveolar surgical cases.[21] It consisted of maximum doses of ibuprofen 800 mg q6h around the clock and acetaminophen taken concurrently 650 mg q6h around the clock for 48 h, starting within an hour after surgery as opposed to loading the patients up pre-operatively with ibuprofen. This helped to stay ahead of the pain but without the blood thinning effect of the ibuprofen increasing the post op bleeding risk. In patients with reported contraindications to taking either medication an alternative regimen consisting of Tramadol 50 mg q6h prn breakthrough pain was prescribed substituting the contraindicated medication in combination with the other. Ultram was so effectively combined with either ibuprofen or with acetaminophen. This pain management regiment has since been routinely and successfully implemented in other clinics with modifications to the maximum medication doses as appropriate given patient comorbidities.[21]

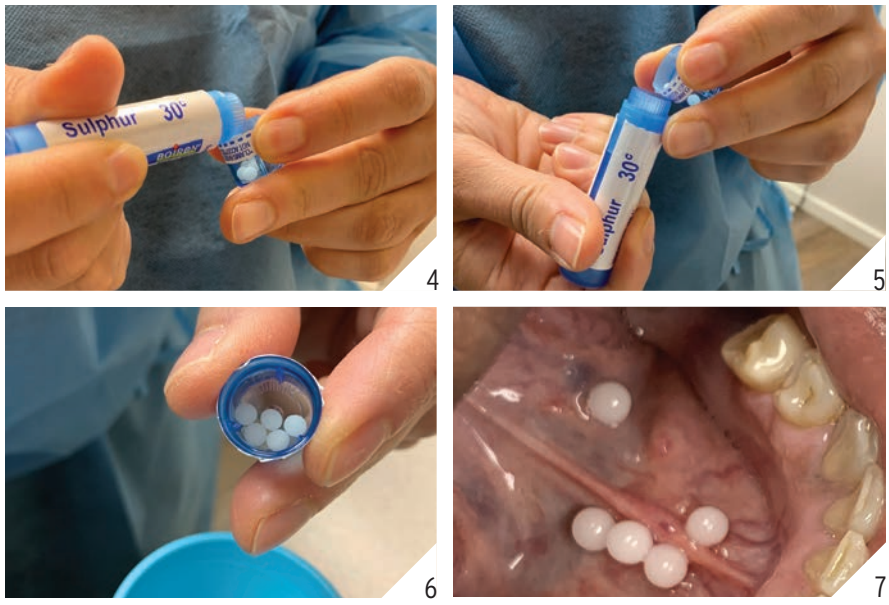
OPTIONS OF ALTERNATIVE METHODS OF PAIN CONTROL.

Many patients know Arnica as antiphlogistic (anti-inflammatory) and analgesic in herbal as well as homeopathic form.[13,5,6]

Homeopathy has been used as a treatment modality since the 1800s and evidence of its safety and efficacy has been documented extensively,[8] yet it remains the most controversial treatment modality in the field of complementary medicine. The reasons for the polarized, at times hostile controversy are rooted in fear of the unknown, which is the greatest fear of all.[9]

CONCLUSION: RECOMMENDATION OF PAIN MANAGEMENT PROTOCOL TO MINIMIZE OPIOID DEPENDANCE IN NARCOTIC NAÏVE PATIENT POPULATION.

There are no national guidelines containing recommendations for dentists on how to prescribe analgesics. In the United States, an ADA statement reviews the Centers for Disease Control and Prevention guidance and encourages dentists to consider primary administration of NSAIDs. It advises



4-7. Chairside dispensing of homeopathic oral pellets.

dentists to check substance use history and PDMPs (Prescription Drug Monitoring System). As well, the ADA policy on opioids suggests limits on opioid dosage and duration to no more than 7 days for acute pain treatment (consistent with the Centers for Disease Control and Prevention guidelines)[38] and encourages continuing dental education on the prescription of opioids.[28] Unfortunately, these statements provide no clinical practice guidelines.

NSAIDS have been routinely used in indicated cases of pain management. Their contraindications are in general GI, urogenital, and nephrotic conditions, as well as allergies and sensitivities to these drugs. Patients with these limitations have minimal options for post operative moderate to severe pain management.[3,4]

Some practitioners use, endorse, and promote pre- and post-operative intraoral topical homeopathic dilutions of Arnica montana with great and reproducible success.[14] Current and classic research is providing evidence-based grounds for clinical application.[8,12-17] Many seasoned practitioners utilize OTC available adjunctive oral and topical homeopathic analgesics and wound healing promoting agents like StellaLife *(Figs. 1-3)* and Arnica montana *(Figs. 4-7)*.

Evidence-based guidelines and curriculum interventions have been shown to shift health care provider behaviours.[18] The implementation of an opioid prescribing guideline for dentists in Ontario led to a 25 pecent reduction in opioid prescribing volume.[39] A 2020 survey of 172 dental residents concluded that changing the culture within the dental residency programs toward reducing the promotion of addiction may aid in reducing opioid overprescribing tendencies during residency training.[40] Another 2021 survey of 586 dental students concluded that dental school curricula are effective targets for shaping the knowledge, attitudes, and prescribing behaviors of future dentists while reducing common misperceptions surrounding opioid misuse, abuse, and diversion.[41,42]

What is holding back progress, innovation and reduced post-operative patient morbidity is lack of education in unfamiliar concepts.[18] That must change!

Oral Health welcomes this original article.

Acknowledgement: Samuel L Rabins, Research Assistant.

Disclaimer: Dr. Diana Bronstein has lectured and recorded webinars for Boiron®

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YOUR HANDS, YOUR HEAD, AND YOUR HEART

Robert Maguire
DDS, MASCL

The current rate of inflation in Canada is 6.9%. Food prices in Canada jumped by 10.3% compared to September 2022. A 2023 Salary Projection Survey published by LifeWorks, a company focused on health and well-being, predicts salaries to rise by only 3.93%. In addition, economists predict that we are heading for a recession.

With the 6.9% rate of inflation outpacing the average salary increase by 3%, patients may decide to cut back on going to the dentist. As a dental practice, how do you proactively plan for your practice to prosper in 2023? I suggest that you do that by using your hands, your head, and your heart.

Your Hands

In 2023, use your hands to continue to suggest and produce the dentistry that is appropriate for your patients. During tough economic times, I've seen dentists back away from suggesting the care that is best for their patients. They assume that because of the present state of the economy, their patients won't be able to pay for it. Steer away from these assumptions as they can put your practice production into a tailspin. Continue to suggest and provide the care that is appropriate for your patients and their oral health. In some instances, you may have to prioritize and segment their care. Do all you can to help your patients maintain their oral health.

Your Head

Using your head refers to looking at how you manage your practice. From a financial perspective, 2023 may not be the year to make a major purchase or undergo a renovation project. Do all you can to maintain a good cash flow. With the rising cost of dental supplies, perhaps now is the time to assign a team member to the task of finding the best prices.

From a systems perspective, do all you can to work efficiently to maintain your production. This may involve you and your team evaluating your present systems, looking for ways to improve and streamline them.

From a patient perspective, make it easy for them to come in for their dentistry. Are you using an automated system to confirm their appointments? Are you offering payment options using an outside provider? Are you doing everything you can to provide convenience for your patients?

Your Heart

Using your heart means taking more time to listen to your patients – their concerns, their fears, and their needs. Being empathetic and connecting with them at the heart level is a great way to keep them coming in. Doing this will take more time and require good verbal skills. When a patient calls to cancel an appointment, gently ask them the reason they are cancelling. Once you know the reason, offer them solutions to help them continue their care. Patients are more likely to come in for their appointments when you help them see the value of maintaining their oral health and offer them assistance with their budgets.

When doing your year-end planning for 2023, remember that your dental practice is both a financial business and a "people" business. As you strategically plan for 2023, it is important to focus on both perspectives. The best way to do that is by using your hands, your head, and your heart. ✧

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KNOX MOUNTAIN DENTISTRY

THE WHY: Owner's story

Dr. Jordan Sanders is the proud owner of Knox Mountain Dentistry, which opened its doors in Kelowna, BC, in 2021. The space was designed and built according to his overall tastes and philosophies. Seven beautiful operatories are well laid out within the 2700 sq. ft facility. With the support of his wife Laura and a love for their two young children, they are super excited to be settled and raising a family as entrepreneurs working out of their very own start-up practice. They are also quite thrilled about the location as they observe Kelowna's demographic evolving from a primarily retirement driven town into a thriving community of young families that love the outdoors and close-to-nature lifestyle.

THE HOW: Planning & preparation

Opening a new office was not Dr. Sanders initial choice for ownership. Although he is generally a very ambitious and driven person, he was quite unsure about an ideal location and unclear on all the specific details required for launching a successful start-up. During dental school, most industry professionals he spoke with seemed to paint Kelowna as a highly saturated and competitive dental market. In 2019, with a vision in his mind and a fire in his belly, he decided to go against popular opinion. He put on his detective hat and began exploring his entrepreneurial options for an attractive acquisition office. After evaluating variables such as location, age of equipment, building issues, lease clauses and

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Peter Barry, C.M.C. PRACTICE SUCCESS COACH

Peter Barry is Founder of Practice Mastery Inc, a Team Development Coaching company that serves the growth & development needs of your practice. He provides customized group and one on-one "Success Training" to dental professionals & industry companies across N. America. FMI IG @peterbarrycoach, peter@practicemastery.com, www.practicemastery.com, 416.568.5456.

other important variables, he decided that none fully resonated with his vision and philosophies. After some reflection, he found an ideal start-up location in the north end of Kelowna where he decided to create his own uniquely flavoured practice from scratch – all while figuring out the exact details of the process along the way.

THE RESULTS: Technical design features

The unit is a ground floor commercial space with residential condos above. It is in the heart of a trending part of the city, with plenty of emerging retail infrastructure and just south of the beautiful Knox Mountain. After successfully negotiating a longer than usual rent-free period, he gathered his design and build team with the goal of integrating a "close to nature vibe" into the internal design of the space. The patient lounge has a uniquely accented moss wall that feels more like a residential living room with a couch, coffee table and arm chairs, where visitors can sit comfortably while enjoying a variety of comforts from the inviting and brightly lit refreshments bar. To enhance office flow, Dr. Sanders wanted a separate office entry and exit to reduce patient bottlenecks at checkout. This layout included an overall plan for minimalist storage inside the operatories, while maximizing the sterilization, supply, and lab areas to contain a cart storage system so procedure setups could be wheeled into the operatories as needed.

THE IMPACT: Empowered practice outcomes

The locals have enthusiastically embraced Knox Mountain Dentistry into their community. Patients enjoy receiving their dental healthcare in a fresh, modern atmosphere that is designed to convey a tasteful, comforting vibe that is felt throughout the culture of the entire team. The whole team is excited to serve heartfelt dentistry into the lives of the people they serve. They are excited to grow and expand their healthcare reach as they become more and more integrated into their beloved community over the years. ✧

Construction: ChrisCan Construction
Equipment Supplier: Sinclair Dental
Interior Design by: Hatch Interior Design

Avoiding Endodontic Malpractice Pitfalls

Several years ago, I read an article published in a popular magazine by a patient who was denouncing the endodontist who had just treated them. After a quick computer search of my patients' files, I was relieved when it was apparent that this was not my patient. However, I reread the article several times hoping to sympathize with their complaints and empathize with the endodontist in question.

The patient who had nonlocalized pain visited an endodontist's office on a Friday morning before a long weekend. There was no doubt they needed a root canal. It was not clear, however, which tooth needed the treatment.

The patient had two choices. Tolerate the pain until it is localized or treat the tooth that was the most probable cause. In pain and desperate to go on a much anticipated weekend camping trip and not having any other options of dental intervention, they chose to proceed with root canal treatment. A few days later, they returned to the endodontist because the pain persisted. The endodontist now advised that the tooth next to the one treated also needed root canal treatment.

This scenario is not unfamiliar to those of us who treat patients in pain. The reality is that in most cases we make accurate diagnoses, we consult with our patients in an informative and caring manner, advising them of all their treatment options.

Recognizing the more common malpractice pitfalls and ensuring that you have taken due diligence to avoid them is a necessity when performing endodontic treatment (or any surgical technique for that matter).

In the case of an uncertain diagnosis, it is always better to err on the side of caution. Even if the patient is demanding something be done, stand your ground and let them know that with time, a proper diagnosis can be made. You could also offer to be available in case of emergency or prescribe analgesics to try and help manage the pain. Most importantly, be firm in your convictions and let them know that the last thing you want to do is treat a tooth that may not be the source of the pain. Ask the patient to consider how they would feel if we ended up treating the wrong tooth? Or how they would feel if we removed the vital tissue from a healthy tooth?

Diagnosis is not always enough. Even if all tests are properly performed, and the proper radiographs are taken, make sure you document your findings to avoid a malpractice action.

If you review the discipline or misconduct hearings section of your regulatory college's publication, you will find that those who are sanctioned have not kept proper records. If your records are incomplete, imprecise, inaccurate, or deficient, it is quite possible that the regulator or judge's impression will be that the treatment you provided was no more thorough than the records.

Let's now assume that the diagnosis was correct, the tooth was endodontically treated, and the documentation was flawless. But the patient returns two years later with pain and a lesion of endodontic origin around the apices, blaming you and requesting a refund for what they perceive as an incompetent job.

After checking the root canal treatment, you notice no issue. All seventeen canals were well obturated to within an acceptable distance from the apices, the tooth was restored with a precision fit crown, and you have the x-rays or scans to prove it. Do you give the patient back the money spent and wish them well? Do you offer to send them to another endodontist and pay for further assessment and treatment? Do you accept no responsibility at all and dismiss the patient from your practice? This rhetoric may sound trite, but these scenarios have occurred with patients who have sought opinions from myself as well as from my colleagues.

Prevention is always the best medicine. Before treatment is initiated, the patient should always be informed that dentistry is not an exact science and not all treatment is successful all the time. If a natural tooth can decay, crack, chip, or otherwise degrade, so too can a restored tooth, crown, or

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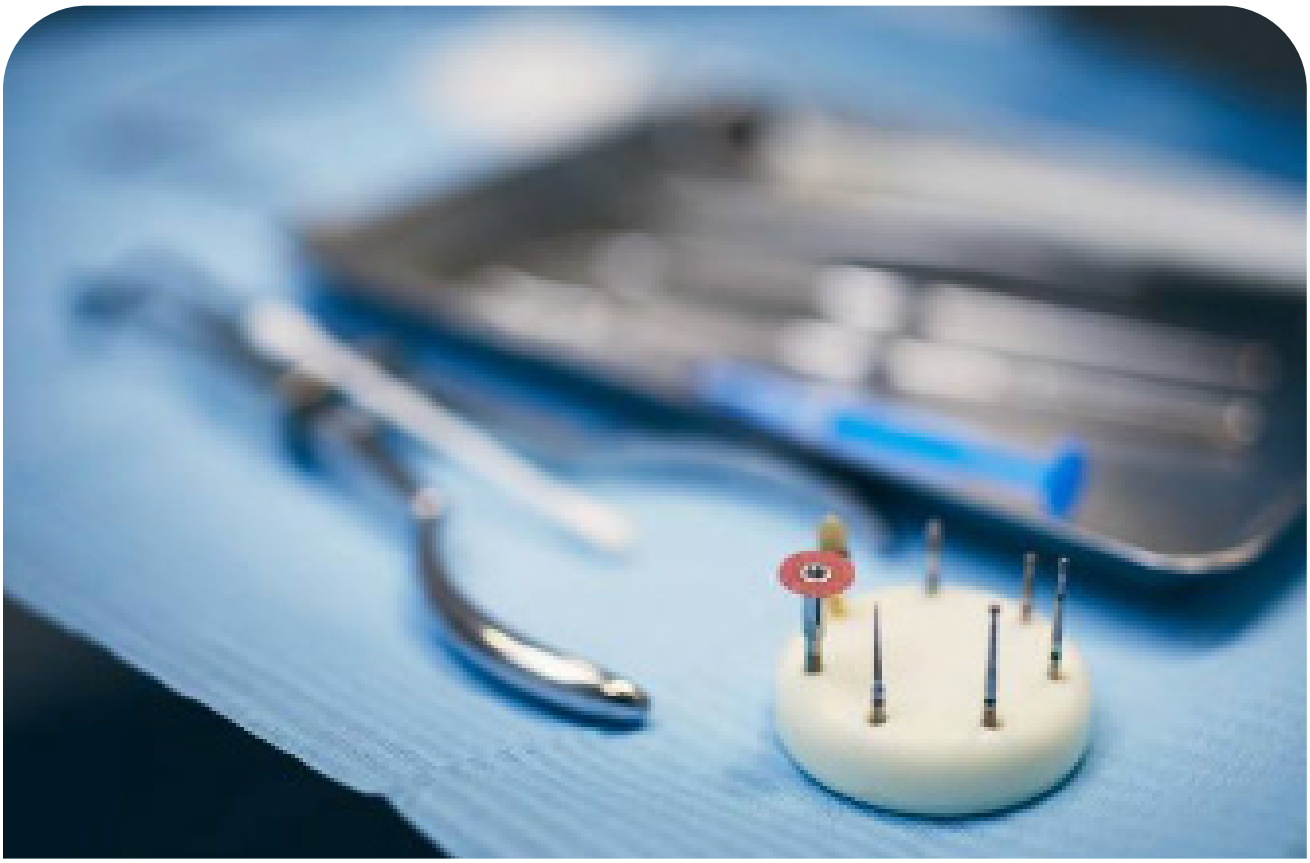

iStockphoto.com / Tero Vesalainen

other appliance. We are human beings performing biological procedures on other human beings. Brynolf and others, many years ago, found that true histological success in endodontically treated teeth showed periradicular healing only 7% of the time. Mind-boggling, isn't it? How you manage each patient's situation is unique, but it is important to be compassionate and understanding.

It is a standard of practice to use a dental dam when performing endodontic treatment. Yet, many practitioners still do not. Not only does a dental dam provide an isolated field for treatment, but, more importantly, it prevents the aspiration or swallowing of those fine reamers and files. So, reduce the risk, practice safe endo, and always place a dental dam.

Unfortunately, procedural misadventures are possible. Perforations, missed canals, and separated instruments rank as the most common. Is it malpractice if a procedural accident occurs? It is not – but it is a departure from the standard of care if the patient is not informed of the complication and its potential consequences. There is no need to hide the fact. Files break, sometimes within the canal, and often with no adverse after-effect. But be sure to inform your patient.

Prevention is always the best medicine. Before treatment is initiated, the patient should always be informed that dentistry is not an exact science and not all treatment is successful all the time.

Dentistry is stressful enough, without having to deal with the extra stress of departing from what is considered standard of care and risking a malpractice action. Consider referring those complex cases or diagnostic perplexities to an endodontist, as they most likely have an experientially different grasp of the internal tooth anatomy and surgical techniques compared to your own. Referring to and/or consulting with a specialist on complex cases is the best possible risk management for the referring clinician. It also helps foster relationships with colleagues that will be there when you're in need. ✧

How to use web stories to boost your practice

You may already be familiar with web stories; they are a more recent phenomenon making significant strides as a successful marketing tool and are now growing in popularity. Since they provide information in small, easy-to-digest doses, they can be effectively used by dental offices to market their services to new and existing patients in the same way social media has been doing over the last few years.

Web stories are similar in features and format to the stories available on social media sites such as Instagram and Facebook. Since clients love reading stories on such platforms, they are bound to enjoy reading web stories in similar formats. This would bring more visitors to your website while also increasing the time they spend viewing it. This could signal to Google that your website is more popular among clients and worth visiting than those of competitors. Read on to see how web stories can benefit your dental practice.

What are Google Web Stories?

Google Web Stories are visually rich, interactive, full-screen format content especially designed for a mobile device that can be used to educate people about a product, service, or basically anything.

Naren Arulrajah, President and CEO of Ekwa Marketing, has been a leader in medical marketing for over a decade. Ekwa provides comprehensive marketing solutions for busy dentists, with a team of more than 180 full time professionals, providing web design, hosting, content creation, social media, reputation management, SEO, and more. If you're looking for ways to boost your marketing results, call 855-598-3320 for a free strategy session with Naren. You may also schedule a session at your convenience with the Senior Director of Marketing - Lila, by clicking https://www.ekwa.com/msm/ or simply send a text to 313-777-8494.

They are hosted on a website through which they can also be promoted. They may include text, images, audio, video, and animation. The text should be short and concise, less than 280 characters, or 40 to 70 words per page. Titles should be less than 90 characters.

First-person narratives, live and updating stories, educational content, polls, and quizzes are some popular content projected as web stories. Promotions, discounts, and special announcements; video teasers; tips and advice; frequently asked questions; social proof and testimonials; and myths and facts are a few areas that can be covered under web stories.

They appear in standard Google Search results and Google Discover. You can feature them as separate content items within your website or embed them similarly to podcast episodes or short videos. Quizzes and polls are interactive elements where your responses are welcomed. If your content is exciting and engaging and the web story feature is optimized, it can help expand the reach of your website while also increasing user interaction and engagement.

A web story could have one or more pages; multiple pages are known as "a set of story pages" and need a cover page. When scrolling through a web story, you can pause the story, navigate between pages, or go to a new story with just a swipe or tap on the screen.

Web stories can appear in Google mobile search results and attract more visitors to your website, as the search results would stand out from the rest as they appear with images. Although you can browse a web story on a desktop computer, a mobile device is the best way to view one, as a web story's height and width specifications suit them better.

Benefits of web stories to a dental practice

- Increase the website's reach to a broader audience as they can be discovered in Google Search and Google Discover.
- Help boost the rankings of your website.
- Help get more click-throughs from search engine result pages as the content is more visual.
- It can boost website engagement-related metrics, indicating to Google that the website is more relevant.

Steps to creating a web story

1. Draft your web story narrative.
2. Choose appropriate editing software.
3. Create your web story.
4. Test your web story before you publish it.

If your content is exciting and engaging and the web story feature is optimized, it can help expand the reach of your website while also increasing user interaction and engagement.

Standard SEO best practices are also applicable to web stories. If you already apply an SEO strategy for your practice, use it when creating your web stories. You should also be aware of SEO elements specific to web stories. An uncluttered, clean design is a must if your web stories are to make their intended mark.

When publishing your web stories, you should pay attention to the following:

- Adhering to the relevant technical standards and best practices
- Posting at least two or three web stories every month
- Ensuring that a good mix of stories is published

Some of these best practices are:

- Focus on videos, but pay attention to images, audio, and animations.
- Use elements that are engaging and interactive to users.
- Use your brand identity to introduce your services to potential patients.
- Ensure your content is web-compatible with proper tools and formats.
- Provide easy access to your web stories.
- Pay attention to Google's SEO standards.

Google web stories are a more recent phenomenon that dental offices can use for marketing their services to new and existing patients, in the same way social media has been doing for years. They are similar in features and format to the stories on sites like Instagram and Facebook. They are interactive, visually rich, full-screen format content especially designed for a mobile device. You can get the best results for your web stories by following the applicable best practices when creating and publishing them. ✧

The Evolving Digital Practice

Dentistry has evolved dramatically for decades due to computers, telecommunications, and various digital equipment interconnection. The days of one-write systems, film-based X-rays, and even fileservers and backup drives will soon be relics of the past.

The term Digital Transformation encapsulates the ongoing migration from analog to digital systems. It is best defined as using digital technologies to create new – or modify existing – business processes, culture, and customer experiences to meet changing business and market requirements. This reimagining of business in the digital age is digital transformation. The IDC estimates that digital transformation investments will increase to more than 53% of combined information and communications technologies by 2023, up from 36% today. The most significant increase will be in data intelligence and analytics.

The key to understanding the implications of digital transformation is knowing that by changing one aspect of the practice, nearly every business process that the office relies on to operate can be affected. Some beneficial outcomes include centralized and on-demand analytics reporting, increased visibility of multi-location data, enhanced patient engagement, data-driven patient insights, improved patient experience, tighter resource management, improved collaboration, agility, productivity, and increased profits, to name just a few.

It should also be understood that digital transformation is an ongoing and evolving process as the underlying technologies that support the functions such as Big data, AI (Artificial Intelligence), IoT (Internet of Things), and cloud computing continue to advance and converge.

From a more practical perspective, today and in the near term, many examples of new digital services are being deployed now, and even more are on the horizon. Here are just a few areas of dentistry that have and will continue to evolve through digital transformation.

Teledentistry: Teledentistry rose in popularity during the pandemic when both patients and practices were unwilling or unable to schedule dental appointments. Advancements in telecommunications, software, and audio/video technology have given dentists the ability to meet their patients in a virtual environment, allowing them to provide dental education, evaluate conditions, prescribe medication, and engage in pre- and post-operation appointments.

Marketing: Few industries have digitized as rapidly as marketing in recent years, which has grown more in the last five years, than the previous fifty. Marketing used to be similar to cold calling, in that companies would send out messages in hopes that the right person sees them. In today's world, the power is with the consumers who make informed decisions using search engines, company websites, social media and online reviews, which they trust as much as personal recommendations. Therefore, not only does a practice need a secure and mobile-friendly website as the new "front door" of the office, but it also needs to consider its search engine ranking, online reputation, social media presence, position as a thought leader, and digital advertising techniques. These categories are typically referred to as the "Marketing Stack" and, if implemented well, can increase service demand as well as improve patient acquisition and retention. Since everything is digital, tools are readily available to help practices better understand how to attract new patients. A well-planned and executed digital marketing strategy is essential to any new practice.

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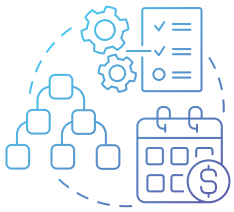
Practice Analytics: Dentists need better decision-making tools to improve services, referrals, and the overall patient experience. A majority of practices today use practice management software to help run their practice, while others have data analysis tools that are now available to provide insights into many aspects of the practice, including reasons for appointment no-shows or cancellations, patient complaints, the popularity of individual providers, frequency of patient issues, patient referral types, and which referral engagement is the most and least effective. As software solutions continue to evolve, an ever-increasing number of solutions will be available to support decision-making based on how key performance indicators (KPIs) are being achieved while validating what areas of the services and processes impact outcomes positively and negatively.

Artificial Intelligence (AI): Instead of searching for ways to work harder, dentistry will begin to look for ways to work smarter. With applied AI, dentists will soon be able to develop insights and improve productivity. Machine learning is a subset of AI, and there are already solutions available to the market that can provide automated interpretation of digital x-rays, including 2D and 3D scans. Machine Learning algorithms provide a "second opinion" in diagnosing tooth decay or predicting whether a tooth should be extracted, retained, or have restorative treatment. AI can also go back in time to find potential missed treatments, paving the way for connecting with patients to complete missed procedures. AI won't stop there; there will soon be a time when it will automate mundane administrative tasks to provide greater efficiencies. In due course, AI is poised to create a significant win-win for dentists and patients. An excellent article on the Evolution of AI in Dental Practice Management Software can be found here: **https://marketbusinessnews.com/evolution-of-ai-in-dental-practice-management-software/294917/**



Practice Management Software: The heart of a practice's digital ecosystem is the dental practice management software, and companies are rapidly advancing their offerings to take advantage of cloud computing. Most Canadian dental practices use traditional on-premise software utilizing the servers and computer networks within the practice. That's set to change as software providers actively deploy full-cloud solutions that will ultimately reduce the IT infrastructure costs while opening many new features and solutions that were impossible with on-premise software. Features such as online booking, text-to-pay billing, automated recall, centralized reporting and analytics for multi-site environments, and the combined features of AI are just the start of new features and benefits to the patient and practice. Full cloud computing will provide a runway for software companies, service providers and digital equipment manufacturers to connect via Application Programming Interfaces (API), paving the way for a more robust, streamlined workflow which will inevitably positively impact the profitability of the practice.

Digital Transformation has and will continually be a significant factor in the decision-making process as the industry looks to automate further and create a superior patient experience. The investments that solo, group practices and DSOs make will be significant in the coming years, and careful budgeting, planning and execution will be critical to success. Selecting vendors with experience in the Canadian market is well-advised as privacy issues, compliance, and experience are always a good idea. It is no secret that Canada may be in for a lengthy recession, so prudent choices in selecting technologies that do what they claim to do is sound advice.

The good news is that the Canadian government has launched the Canadian Digital Adoption Program to support Canadian small to medium size enterprises. The program includes a $15,000 grant that covers up to 90% of the consultation costs of a digital advisor, up to $100,000 interest-free loan to cover the cost of implementing the digital adoption plan, and finally, a $7,300 youth wage subsidy to hire a role to support your digital transformation. Information regarding the program can be found at these resources: **https://cdap-advisor.com/ and https://ised-isde.canada.ca/site/canada-digital-adoption-program/en?open**

Two, Four, Six, Eight!
Maximize and Appreciate!

PLANNING FOR RETIREMENT: **PART 1 OF 3**

As the adage goes, "failing to plan can mean planning to fail." As health care entrepreneurs, we are responsible for the creation of our own retirement pensions through a career of hard work, smart planning, and effective strategies. Planning for the day when we elect to hang up the handpiece starts many years in advance.

Getting Ready for the Next Phase:

Practice owners have a unique advantage amongst healthcare professionals, with the sale of a dental practice offering a major asset to the financial portfolio that other allied health professionals don't all get. And as with the sale of any asset, maximizing the net result of that sale is imperative. How a practice is sold and when a practice is sold are key considerations to ensure the top price is paid to you, and the minimum tax is paid to Ottawa.

Often, a practice sale represents part of the retirement portfolio but not all of it. Creating financial wellness through a long-game approach certainly helps level some of the peaks and valleys in the market and facilitates your advisory team in creating a plan that matches your lifestyle as you consider retirement. The transition of exiting practice ownership and later exiting practicing dentistry should also be part of the plan. This article is the first in a three-part series that will review some of the major considerations that should be discussed with your advisory team that support comprehensive retirement planning.

TWO! There are typically two ways a dental practice is sold

Ask yourself these questions if you're considering selling your practice: Why do you want to sell? And how do you plan on selling?

WHY: Perhaps selling your practice is motivated by a straightforward goal of retirement and, simply put, "its time." Perhaps it is because you are looking for more support in the management of your practice in which case there may be a consideration of selling to a DSO or investor that can provide this support while you continue to practice. Regardless, the motivation to sell your practice often influences the strategy that will be engaged by your dental practice brokerage.

HOW: This is your financial strategic plan. The two most common ways a dental practice is sold is as a share sale or an asset sale. With the benefits of the lifetime capital gains exemption (LCGE) providing up to $913,960 (2022 numbers) in shareholder tax free gains upon sale for a dentistry professional corporation (DPC), most practices sell as a share sale. To qualify for the LCGE, the DPC must have been in operation and owned the practice for a minimum of 24 months for each qualifying shareholder. But there are instances where a share sale may not be the best decision. Practice owners that have maxed out their LCGE may elect to sell their practice as assets and not shares. In the valuation world, an asset purchase represents an opportunity for a buyer as the

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purchase is depreciable. This is not the case in a share purchase. Therefore, the cost of capital allowance and the depreciation of the acquisition over time creates an advantage to the buyer that should be reflected in the appraised value of the practice. Not all appraisers consider this, which can be harmful to the selling dentist. In the case where a practice owner owns more than one practice, there may be certain strategic considerations that suggest an asset sale is beneficial for one practice and share sale for another. The point here is that how you sell your practice is a consideration that requires a planned strategy, ideally years in advance of execution.

FOUR! There are four ways to maximize your practice's value

Maximizing your practice's value at the time of sale has obvious advantages. A practice running optimally not only increases the value, but also the demand. Demand reflects buyer interest, and buyer interest drives up price paid. Not all practices sell at their optimal state of operation, which makes sense since dentists nearing the sale of their practice often have elected to slow down and have reduced financial pressures compared to purchasers. But optimizing operations in preparation of sale has tremendous advantages for the vendor. Here are the top four ways to maximize a practice's value:

Maximize Cash Flow:

It's not what we make but what we keep that matters. One of the authors of this article is a dental practice appraiser who is often asked, "What's my appraised value as a proportion of my top line revenue?" It's an unanswerable question. Top line revenue doesn't matter. A practice that grosses $1.5M and nets $600K has a very different affordability and value compared to a practice that grosses $1.5M and nets $400K. Sometimes the best way to increase value is in fact to increase top line revenues, but often there are opportunities to create efficiencies in operations that result in net revenue increases. Having a practice consultant review your operations and determine where efficiencies can be created and where opportunities lie can pay for itself in less than 3 months of operation in some cases. And with today's tight margins in dentistry, inflation, and the volatile investment market, investing in yourself is often the best investment you can make. After all, who cares more about your hard-earned money than you do?

Nail Down the Office Lease:

Leases don't always add value to a practice, but they can diminish it in a hurry. Many dentists have practice leases with relocation clauses, demolition clauses, transferability limitations, and terms that can impede a practice sale altogether. This is devastating for a vendor to find out at the time of their appraisal if they intend on selling their practice in the near future. Far too often dentists assume the terms of their lease are not an issue because they have "never had an issue with the landlord." But lease clauses that exhibit any form of risk to a lender can prevent financing and cost six or seven figures if acted on.

Invest in Efficient Technology:

The investment in clinical technology and automation has created efficiencies in modern dentistry that many patients now depend on and also serves to address the reduced availability of staff. Automated email or text reminders and confirmations for patients reduce staff time for this task and create ease and simplicity for practice operations. Hygiene recare programs can support your primary practice management software to stay on top of overdue patients and fill your schedule..

The Right Team:

In a goodwill-based business, having the right people in the right roles remains the most predictable way to increase a practice's value. Regardless of how automated our world becomes, nothing can substitute the trust and care that is created by a sincere human interaction.

In the next article we will review six critical themes that create a framework to maximize wealth and minimize risk. ✧

THE PATIENT EXPERIENCE

Nowadays, we are providing more than dental appointments, we are providing patient experiences. The patient experience is more than a buzzword. It has been proven that positive patient experiences increase health outcomes and decrease patient complaints.[1]

What is the patient experience? Although there is no established definition, the patient experience is more than providing care; it is how well the patient feels cared for.

Patients will have a positive experience when they feel we understand and meet their needs, that we are doing things in their best interest and we respect and appreciate them.

How can we deliver 5-star service to our patients? Read on to hear how some dentists are providing great patient experiences.

Dr. Ramez Salti
General Dentist,
Multiple locations, Toronto, Ontario

The way I transform a patient appointment into a patient experience is by focusing on the patient relationship and how the patient feels.

I practice at several offices doing oral surgery and implants under IV sedation. My patients are often nervous so I take the time to gain their trust and find ways to make them more comfortable. I ask them what makes them nervous and what I can do to make them calmer. This can involve giving them a weighted comfort blanket, oral or IV sedation, or simply talking to them.

In one appointment, I met a 4-year-old little girl named Charlotte, wearing a watermelon printed dress with blood spots on it due to experiencing a fall just hours earlier. She was scared, and so were her parents. I knew I had to win their trust before I even thought about the dental treatment. I asked questions about her watermelon clothes and her favourite colour. I let her mom sit in the chair with Charlotte. The fear went away as they saw me as a friend who was eager to help. Because of that, she let me remove her broken front teeth and was beaming when she held her tooth fairy box.

Besides making the patient feel comfortable and gaining their trust, another way I serve my patients is by providing customized care. I do this by learning the patient's unique learning style. Some patients are visual learners so I show them pictures and radiographs. Other patients are detail oriented and require specifics about their dentistry. Other patients are not interested in details at all – they simply want their dental treatment completed. Taking the time to understand patients enhances connection and provides a truly remarkable patient experience.

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Dr. Peggy Bown
General Dentist, Luxe Dental Group, Saint John, New Brunswick

I believe the patient experience is the sequence of events and sensory experiences that the patient encounters at every point of contact. It starts before the patient comes to your office and continues after the appointment. For example, what impression does your online presence give? Is it easy for patients to find your office? Do you take the time to understand your patients? How do you correspond with them after appointments? If you exceed their expectations, you are more likely to get great reviews and more referrals.

How do we go beyond patients' expectations? We give our patients the VIP treatment. We make them feel special by getting to know them first. We share laughs and stories so they feel like friends coming over for a visit. We offer refreshments, pillows, blankets, hot towels with essential oils and lumbar support. During treatment, patients lay back and watch a video of their favourite destination while listening to relaxing music. It's like a first-class trip.

All the touch points – from the office design, to the technology and materials, to the way we communicate – are centred on providing a positive patient experience. Our office has spa-like colours, wide hallways, bright lighting, open spaces and clutter-free rooms. We use intra-oral scanners and cameras and smile simulations to educate and engage. Not only do we focus on what patients see, but we also think about what they taste and smell when choosing our materials. Responding to messages and calls quickly, running on time and having compassionate and competent team members are other ways we make the patient feel valued.

Doing things to make patients happy also makes us happy. The dentistry is not the game; serving patients and exceeding their expectations is the game. No amount of good dentistry will build a practice without a great patient experience.

The patient experience is more than a buzzword. It has been proven that positive patient experiences increase health outcomes and decrease patient complaints.

Dr. Faraj Edher
Prosthodontist, Transcend – Specialized Dentistry, Vancouver, British Columbia

I believe the patient experience is all about how patients feel and what they experience using their 5 basic senses. This applies to everything before, during and after their dental visit.

It has been interesting to build a new dental office in Vancouver where we designed the office with the patient experience in mind. We visualized the patient walking through the office and thought about what the patient experiences with each step. For example, patients hearing conversations between team members and insurance companies at the front desk doesn't enhance the patient experience, so we ensured that these phone calls take place in a different private area, so the front desk area can focus on greeting patients and making them feel welcomed and comfortable.

An example where focusing on the patient experience resulted in a better result and happier patient was when I had a challenging case of making an anterior crown on a patient with a high smile line. When I inserted the crown for the try-in, she was so happy she had tears in her eyes. I saw that there were some minor improvements that could be made to the line angles and contours of the restoration. I could have cemented it and let her go, but instead I said, "The crown looks good, but it can be better." I explained how it could be improved and she trusted me to make the changes needed. She was so thrilled with the result that she referred several friends and co-workers to see me. She appreciated that I took the time to give her the best care, even when she would not have known any better. She embraced and adopted what I said to her and until this day messages me when she says to someone, "Good is not good enough – we aim for great."

Dr. Sanjukta Mohanta
General Dentist, WellFort Community Health Centre, Brampton, Ontario

For me, the patient experience involves making the patient feel welcomed and valued. I work at a community health centre where I care for children and seniors on public dental programs. Our vision statement is "A Healthier Community Where Everyone Belongs." One of the ways I make patients feel welcome is that I go to the Welcome Room (we don't call it a waiting room) and greet the patient and anyone that comes with the patient. Then I invite them all into the operatory and hang up their coats and seat them. It makes them feel like they are coming into my home instead of a dental office.

I do some simple things that make patients feel valued. I thank them for coming in at the start and end of the appointment. I slow down my breathing and speech so I seem present and not rushed. I sit in front of them and ask them about themselves before picking up an instrument. Getting to know my patients makes them feel that I care about them as people first and their teeth second.

Placing patients first not only improves the patient experience, it also enhances the clinical experience. For example, the other day I was struggling to place a matrix band on a wide prep on the 26 distal. The assistant and I were trying different things and we were frustrated. As the tension built, the patient gripped the chair. Then I stopped thinking about the tooth and started thinking about the patient. I put down my instruments and looked at the patient and said, "Are you doing okay? Sorry this is taking longer than expected. Let me know if you need a break. We are doing our best to take care of you." Immediately everyone became more relaxed and the procedure went well. The patient was very appreciative that we worked so hard to get it right and that we made sure he was alright.

Another way to provide a positive patient experience is to show that you are enjoying the dentist experience. When your patients see that you love being at the dental office, they will too!

Conclusion

You just learned some great ways to create a positive patient experience. Now it's your turn. Transform the dental appointment into a patient experience and you will enjoy a blossoming workplace culture, heightened clinical outcomes and a greater sense of fulfillment. ✧

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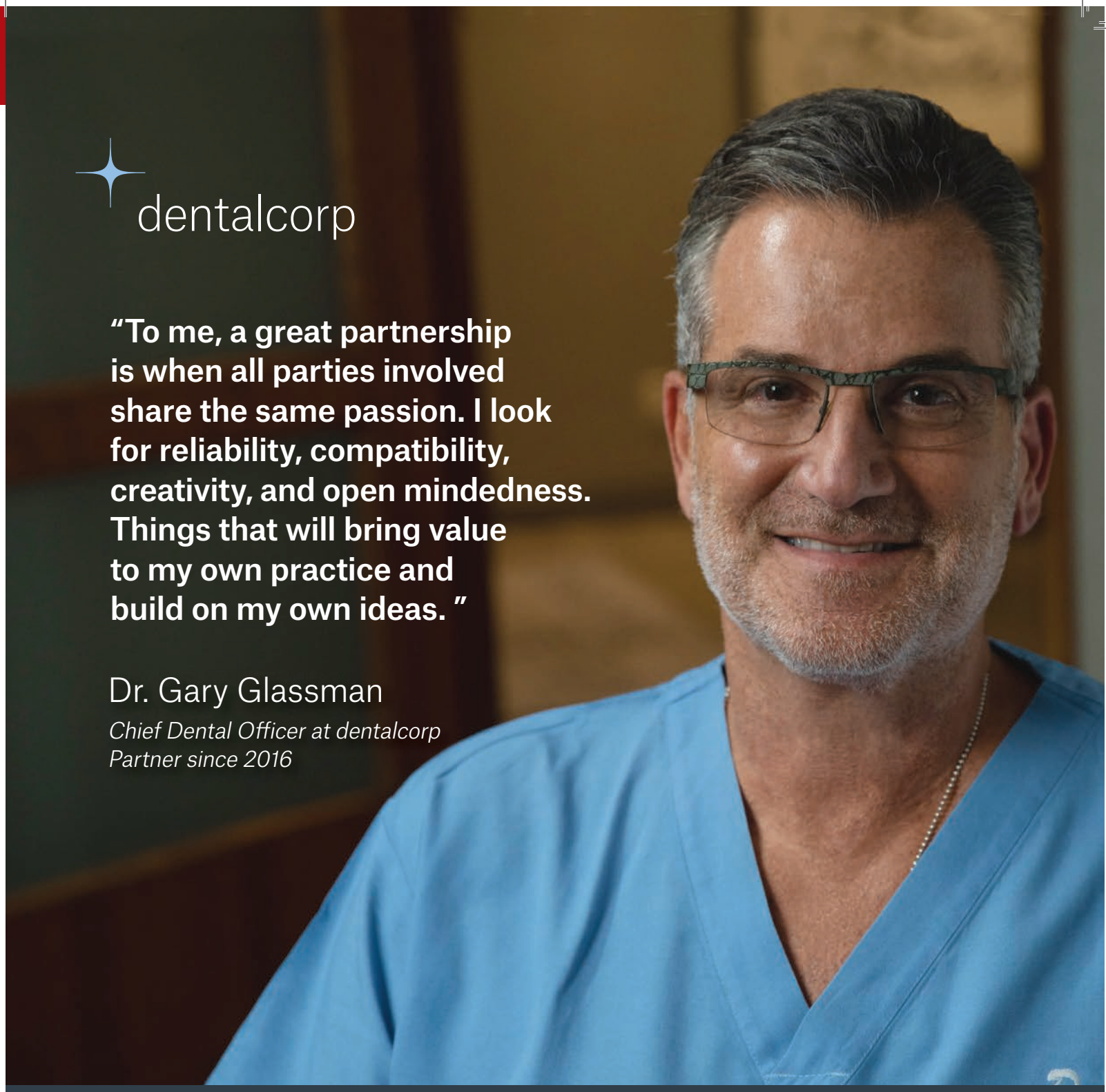

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Must be comfortable working with all ages including children and seniors as we are a family practice. Has good clear and respectful communication skills with both patients and the team.

You must be licensed to work as a dentist in Ontario and in good standing with the RCDSO. We are looking for Wednesdays 11 am to 8 pm with the future possibility to add.

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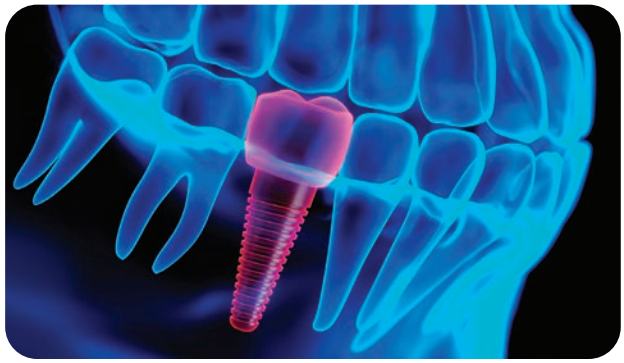
Lou Shuman, DMD, CAGS, CEO and Founder of Cellerant Consulting

Lou Shuman, is the CEO of Cellerant Consulting Group, dentistry's leading corporate incubator and accelerator. He is a venturer in-residence at Harvard's i-Lab, co-founder of LightForce Orthodontics, a member of the Oral Health advisory board and founder of the Cellerant Best of Class Technology Awards. He was selected in 2021 by Global Summits Institute one of the World's Top 100 Doctors.

Aerospace. Aeronautics. Automotive. World-class precision engineering is vital for manufacturing legends such as Ferrari, Jaguar, Tesla, Maserati, Mercedes, Aston Martin, and NASA. Ditron makes critical components for those companies, and the same high quality that sets those icons apart now is the driving force behind Ditron Dental USA implants.

Dr. Matteo Danza provided the implant know-how and Dr. Ole Jensen and Mike Stevens, Ditron Dental USA's CEO and Co-Founder, had the vision to create the first-of-its-kind doctor-driven dental implant company. The goals, says Stevens, were to develop "next-generation products created by dentists at the highest level of implant dentistry backed by a knowledgeable and creative clinical advisory board that provides feedback and helps us continue to develop this product."



One of the crucial elements behind these implants is titanium manufactured to a sub-micron level. Ditron is one of only three companies in the world that can reach that level of precision, eliminating the "micro-gap" between the abutment and the implant. "At Ditron, we call that the MolecuLock™ connection," says Stevens. "One of the most crucial aspects of avoiding peri-implant disease is the intimacy of fit between the abutment and the implant." Besides avoiding bacterial contamination, the connection also improves long-term bone-level stability.

Preserving bone is a defining feature of the company's MPI™ and ULT™ implants. David Lee Howell, Ditron Dental USA's vice president of sales says, "The reverse concave neck (RCN) puts put less pressure on the crestal bone. The tapered shape and micro-threads also reduce pressure to the cortical bone, providing atraumatic contact." Micro-threads also improve the speed and quality of osseointegration.

While the implants come in a variety of sizes, both types have a single connection at the implant and the abutment. "That means one impression post, one digital scan body, and one analog that all work together," says Howell. "You don't have to stock multiple sizes, even if you are working on full arch – keeping costs and inventory down."

Creating precision implants is in Ditron Dental USA's DNA. But the company is also focusing on more – growing their customers' practices. That's at the heart of "Ditron Dental 360," a new program that involves the clinician and the whole practice team to add value to the implant practice. Howell explains, "We ask about their goals – how many more implants do you want to place next year? And we have vehicles to help dentists reach those goals." Millions of dollars of possible treatments written in existing patients' charts have been suggested but not yet accepted. "From the receptionist to the treatment team, we coach techniques to start the conversation on what it would take to help these patients start treatment. Maybe it's a discount; maybe better understanding of the procedure, maybe both. We can even help educate the doctor on full-arch case techniques," says Howell.

"Dentists need to experience the advantages of our precision-engineered implants for themselves," says Stevens. "But we want to do something even bigger – we want to leave something behind for generations to come and that will make a huge impact for patients' lives. That's the goal."

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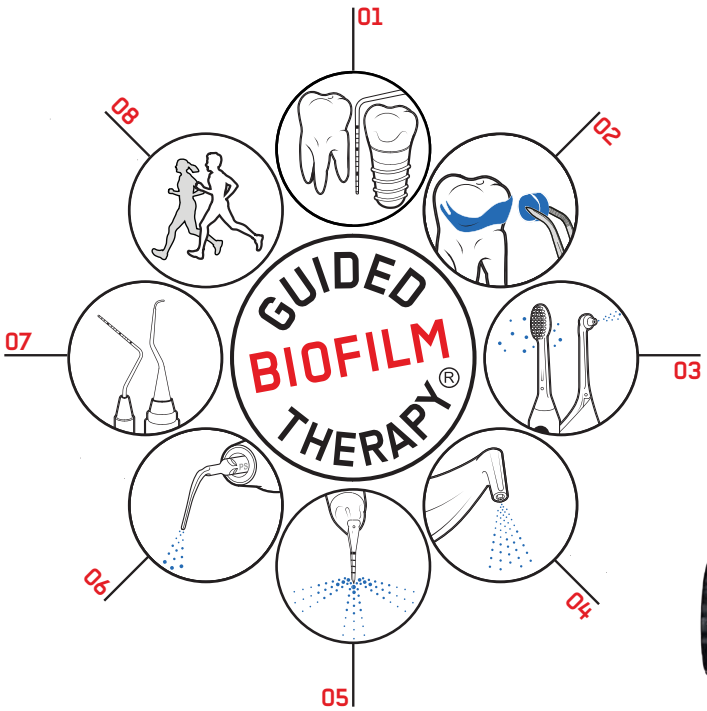

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Au-delà de l'ostéointégration : améliorer la réussite et la préservation des implants

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Les implants dentaires sont un outil clé dans l'arsenal dentaire pour le remplacement des dents manquantes. En l'absence de contre-indications chirurgicales, de facteurs de risque majeurs pour les patients et de restrictions financières, les implants dentaires sont la modalité de traitement privilégiée pour le remplacement des dents manquantes. En témoigne la multiplication par 8 de la prévalence de la dentisterie implantaire en Amérique du Nord entre 1999 et 2016 et la projection d'une multiplication par 4 d'ici 2026[1]. Cela dit, les implants ne sont pas une panacée et sont sujets à des complications esthétiques, biomécaniques et biologiques[2]. Les maladies péri-implantaires (mucosite péri-implantaire et péri-implantite) sont les complications biologiques les plus courantes en dentisterie implantaire. L'objectif de cet article est d'explorer une approche d'équipe visant à minimiser le risque de complications liées aux implants biologiques. L'accent sera mis sur les approches proactives et centrées sur le patient pour l'entretien des implants et la routine complète des soins buccodentaires à domicile.

Atteindre et maintenir l'ostéointégration

La pierre angulaire de la dentisterie implantaire est le processus d'ostéointégration, qui a été défini par Branemark en 1985 « comme la connexion structurelle et fonctionnelle directe entre l'os vivant et la surface d'un implant sans tissu fibreux intermédiaire »[3]. L'ostéointégration permet la fixation rigide des implants dentaires oraux aux os de la mâchoire, soutenant ainsi la superstructure prothétique qui les recouvre. L'ostéointégration est fiable et prévisible. Cela est démontré par la faible incidence (1 à 2 %) de l'échec prématuré de l'implant, défini comme la perte d'intégration de l'implant avant l'établissement d'une connexion prothétique et la mise en charge[4]. Le maintien de l'ostéointégration est toutefois plus difficile. Bien que l'on puisse s'attendre à des taux élevés de survie et de réussite des implants **(>90 %)**, des complications et des échecs d'implants sont malheureusement fréquemment rapportés dans les études de suivi à long terme[5]. Alors que les échecs d'implants peuvent être décrits comme des échecs esthétiques (par exemple, des implants mal positionnés) ou biomécaniques (par exemple, des fractures d'implants), cet article se concentre sur les échecs biologiques ou les maladies péri-implantaires.

Les maladies péri-implantaires (figure 1) sont définies comme étant soit une mucosite péri-implantaire, soit une péri-implantite. La mucosite péri-implantaire se caractérise par un saignement lors d'un léger sondage, un érythème et un gonflement gingival péri-implantaire (avec ou sans suppuration), et par une augmentation de la profondeur de sondage péri-implantaire. Il est important de noter qu'une augmentation de la profondeur de sondage est causée par un gonflement gingival et une diminution de la résistance au sondage, par opposition à une perte osseuse péri-implantaire. La péri-implantite partage de nombreuses caractéristiques cliniques de la mucosite péri-implantaire, comme le saignement au sondage, l'érythème et le gonflement gingival (avec ou sans suppuration) et une augmentation de la profondeur de sondage péri-implantaire. **Cependant, la caractéristique principale de la péri-implantite est la perte osseuse péri-implantaire progressive et souvent rapide[6]**. Si elle n'est pas détectée ou traitée, la péri-implantite peut entraîner l'échec ou la perte de l'implant, ce qui peut avoir des conséquences financières importantes pour le patient et le clinicien.

Image 1. Complications liées aux implants biologiques

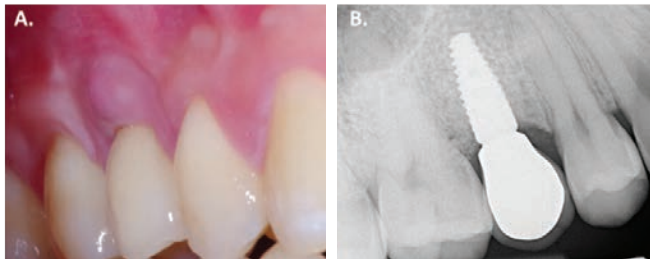
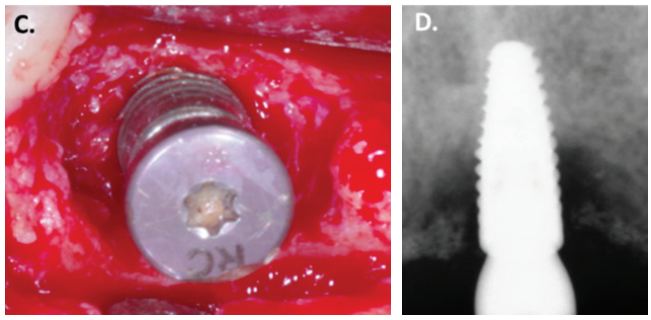


Fig 1. La mucosite péri-implantaire (Fig 1A., 1B.) se caractérise par un saignement au sondage, un érythème et un gonflement gingival et par une augmentation de la profondeur de sondage péri-implantaire en l'absence de perte osseuse péri-implantaire.



(Fig 1C., 1D.) La péri-implantite partage les caractéristiques cliniques de la mucosite péri-implantaire ainsi que la perte osseuse péri-implantaire.

Une approche d'équipe pour éviter les maladies péri-implantaires et augmenter le succès des implants

La longévité des implants dentaires est influencée par de multiples facteurs, notamment les facteurs liés à l'implant, les facteurs liés à la chirurgie, les facteurs liés à la restauration/prothèse, les facteurs de risque liés au patient et les facteurs liés à la maintenance de l'implant - voir tableau 1[7,8]. Tous les membres de l'équipe dentaire, dont le chirurgien, le dentiste restaurateur, le laboratoire dentaire, l'hygiéniste dentaire, et surtout, le patient, doivent être au courant de leurs rôles respectifs et doivent être des participants actifs dans la prévention des complications liées aux implants biologiques.

Tableau 1. Facteurs contribuant à la maladie péri-implantaire[7,8]

Facteurs de risque de développement d'une maladie péri-implantaire	
Conception des implants	• Implants lisses (usinés) • Implants sans commutation de plate-forme
Patient	• Tabagisme • Parodontite • Mauvaise hygiène buccodentaire • Diabète non contrôlé
Chirurgical	• Mauvaise qualité des os • Volume osseux inadéquat • Absence de tissus kératinisés fixés • Implant mal positionné
Procédure de restauration	• Excès de ciment • Mauvais profil d'émergence • Fortes forces occlusales • Contrats ouverts • Impaction alimentaire excédentaire
Entretien	• Entretien dentaire irrégulier • Patient non assidu • Instrumentation incorrecte de l'implant • Manque de soins à domicile

Une approche d'équipe : chirurgien dentaire

Le chirurgien dentaire est responsable de l'établissement des antécédents médicaux et dentaires pré-chirurgicaux du patient afin d'identifier les principaux facteurs de risque liés aux complications des implants[9]. Le chirurgien doit examiner la zone chirurgicale de manière clinique et radiographique afin de tenir compte de toutes les restrictions et limitations anatomiques et de s'assurer que la zone est bien adaptée à la pose d'un implant. Idéalement, les tissus mous et les déficiences osseuses doivent être corrigés avant la mise en place de l'implant. Le chirurgien et le dentiste restaurateur devraient collaborer à un plan de traitement par implants prothétiques. Le chirurgien doit alors faire tous les efforts raisonnables pour placer de manière optimale un implant approprié dans une position idéale, comme le dicte le plan prothétique. La meilleure façon d'y parvenir est d'utiliser des techniques chirurgicales implantaires guidées afin de minimiser les erreurs de positionnement au moment de la pose de l'implant. Le chirurgien doit ensuite confirmer l'ostéointégration et la stabilité de l'implant avant de transférer le cas au dentiste restaurateur.

Une approche d'équipe : dentiste restaurateur

Le dentiste restaurateur (en partenariat avec un laboratoire dentaire) est chargé de s'assurer que la prothèse est bien conçue et peut répondre aux besoins esthétiques et fonctionnels du patient. Dans la mesure du possible, les implants doivent être restaurés avec une prothèse amovible et vissée, car l'excès de ciment est un facteur de risque bien connu de maladie péri-implantaire[10]. Si la prothèse implantaire doit être scellée, il faut veiller à éviter l'extrusion de l'excès de ciment au niveau sous-gingival. Les forces occlusales sur la prothèse implantaire doivent être légères, avec peu ou pas de forces excursives, et les contacts proximaux doivent être serrés et nettoyables. Les forces occlusales importantes et les habitudes parafonctionnelles doivent être identifiées et contrôlées pour éviter les complications biomécaniques telles que le desserrage ou les fractures des vis prothétiques. Les paramètres cliniques et radiographiques doivent être enregistrés au moment de la restauration des implants afin de servir de référence pour la détection de futures maladies péri-implantaires.

Une approche d'équipe : dentiste/hygiéniste dentaire

Le dentiste ou l'hygiéniste dentaire doivent avoir une parfaite compréhension de la définition de cas de la mucosite péri-implantaire et de la péri-implantite pour être en mesure de reconnaître les signes précoces de la maladie péri-implantaire. À chaque rappel, il convient de mettre à jour les antécédents médicaux et dentaires du patient, puis de procéder à un examen clinique et parodontal complet. L'examen doit inclure l'évaluation du contrôle de la plaque, du saignement au sondage, des profondeurs de sondage péri-implantaires, de la mobilité de la superstructure ou de la fixation de l'implant, de l'évaluation des forces occlusales et des contacts proximaux. Des radiographies ne sont pas nécessaires à chaque rappel, à moins qu'il y ait des preuves cliniques suggérant une maladie péri-implantaire progressive. Tout changement notable par rapport aux valeurs initiales doit être noté et traité immédiatement. Il existe des preuves solides identifiant la plaque comme un facteur étiologique clé pour le développement de la mucosite péri-implantaire et de la péri-implantite[6] (Figure 2).

Un débridement minutieux de l'implant est requis à chaque visite de rappel en utilisant un instrument sécuritaire pour les implants qui n'endommage pas l'implant/le pilier et n'augmente pas la rugosité de leurs surfaces[7]. Les patients doivent être informés de l'importance des rappels professionnels de routine et du contrôle de la plaque dentaire, et l'accent doit être mis sur la prévention des maladies péri-implantaires, car le traitement des maladies péri-implantaires (en particulier la péri-implantite avancée) est souvent imprévisible et coûteux[11].

Fig 2. La plaque/le biofilm est un facteur étiologique clé pour le développement des maladies péri-implantaires.

Impliquer, éduquer, équiper, réussir : une approche fondée sur des données probantes pour les soins à domicile aux patients

La dentisterie par implants n'est pas une science exacte et il y aura toujours un risque de complications. Cependant, ces risques peuvent être réduits au minimum lorsqu'une équipe expérimentée de professionnels dentaires travaille en synergie pour planifier, exécuter et maintenir un implant. Cela dit, en l'absence de participation, d'implication et de propriété des soins à domicile, les complications liées aux implants sont inévitables (Figure 3).

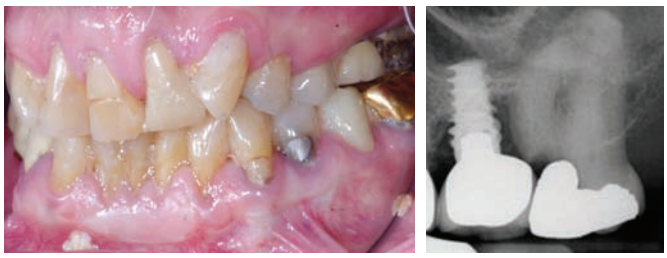


Fig 3. En l'absence d'implication et de propriété des soins à domicile, les complications liées aux implants sont inévitables.

Le meilleur service que nous puissions offrir à nos patients est d'éduquer, de motiver et de leur donner les moyens de devenir un participant actif dans les soins à domicile et l'entretien de leurs implants dentaires. L'équipe dentaire doit concevoir et recommander un régime personnalisé de soins à domicile, appuyé par la science, qui fournit aux patients les outils et les ressources nécessaires pour gérer et entretenir efficacement leurs implants dentaires. Les patients se tournent souvent vers leurs professionnels dentaires de confiance pour qu'ils leur donnent des conseils sur la manière de prendre soin et d'entretenir leurs dents/implants. **Il est de notre responsabilité collective de nous assurer que nous fournissons à nos patients les outils appropriés** nécessaires pour prévenir l'accumulation de plaque autour des implants dentaires de manière sûre et efficace.

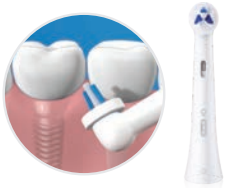


Fig 4. La brossette Oral-B iO Nettoyage ciblé pour l'entretien de l'implant.

Les brosses à dents électriques oscillo-rotatives sont efficaces dans l'élimination de la plaque autour des implants[12], tandis que le dentifrice au fluorure stanneux stabilisé (SnF_2) a été démontré comme étant sûr et biocompatible avec les implants en titane[13]. Une étude clinique de 12 mois sur 80 patients péri-implantaires utilisant une brosse électrique à rotation oscillante a confirmé l'efficacité de la brosse électrique pour améliorer les paramètres cliniques péri-implantaires par rapport aux brosses manuelles. Plus important encore, la brosse électrique à rotation oscillante n'a pas eu d'effets délétères sur les tissus mous péri-implantaires et a été très bien acceptée par les patients[13].

Fig 5. Un régime de soins à domicile, soutenu par la science, joue un rôle clé dans le succès et la préservation des implants.

Les dentifrices SnF_2 ont également l'avantage distinct de posséder des propriétés antibactériennes en plus de leurs propriétés anticariogènes. Il a été démontré que le SnF_2 réduit la production métabolique de toxines bactériennes, supprime la virulence pathogène et favorise la symbiose entre la bactérie et l'hôte dans les dents naturelles[14-16]. Le nettoyage interproximal avec la soie dentaire traditionnelle est recommandé autour des implants, mais il est souvent mal accepté en raison des problèmes de dextérité et du manque de confort. Pour surmonter ce problème, les brosses interdentaires et un hydropulseur devraient être recommandés à tous les patients porteurs d'implants. Un hydropulseur peut permettre une irrigation confortable, ciblée et aérobie des zones entre les dents difficiles à atteindre et des zones sujettes à l'accumulation d'aliments. Il constitue donc un complément utile à l'entretien et aux soins à domicile des implants dentaires.

Conclusion

Le traitement par implants dentaires nécessite un investissement financier et temporel important de la part du patient et de l'équipe dentaire. Les complications liées aux implants constituent un problème grave et souvent coûteux pour le patient et l'équipe dentaire. L'incidence des complications liées aux implants peut être réduite lorsque l'équipe dentaire travaille ensemble pour fournir des soins exceptionnels tout en adoptant une approche proactive en impliquant le patient dans le soin et l'entretien de ses implants dentaires.

Balayez le code QR pour suivre le cours de formation continue sur la classification des maladies parodontales et péri-implantaires de l'AAP/EFP 2018, qui vaut 3 heures de crédit de formation continue.

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