The “Super-Specialty” of Minimally Invasive Dentistry
An Interview with Dr. Graeme Milicich

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Dr. Milicich is a Fellow, Diplomate, and founding board member of the World Congress of Minimally Invasive Dentistry. He is also a Fellow, Master, and board member of the World Clinical Laser Institute, and a founding board member and honorary lifetime member of the New Zealand Institute of Minimal Intervention Dentistry. In this interview, Dr. Milicich answers questions from Drs. David Eshom and George Tysowsky.

Dr. Milicich will be speaking at the 28th Annual AADC Scientific Session in Washington, D.C., on May 4, 2012.

Q: Dr. Milicich, you have been a researcher, lecturer, and practitioner in New Zealand for 35 years. What led to you becoming a leader in developing the “subspecialty” of minimally invasive (MI) dentistry?

A: I was embracing mechanical MI concepts even before I graduated dental school in 1976. Notice, I say “mechanical” at this point, because the reality of true MI dentistry is to do nothing. To do that you have to effectively deal with the disease, dental caries, and help your patients attain true oral health, rather than just being a dental mechanic cutting smaller preparations. Sadly, this approach did not “gel” with me in the first half of my career.

It is interesting that you describe MI dentistry as a “subspecialty.” From my perspective, MI is an all-encompassing concept and philosophy that extends to involve all dental specialties so that it actually is a “super-specialty,” encompassing all of dentistry; the subspecialties to MI would then be what we currently describe as specialties. As technologies, materials, and techniques have advanced, MI has taken hold not only in dentistry, but all across medical care. Diagnose early and accurately, then treat with MI techniques and adjunct materials and morbidity is reduced. That is what MI is all about.

There is a story I like to tell about when I was at dental school and was faced with the preparation of my first mesial-occlusal (MO) cavity in 1974. I have a mechanical bent, and even then, I struggled with G.V. Black’s cavity designs and how, to me, they seriously compromised the biomechanical integrity of the tooth. We are constantly faced with the evidence of this compromise with all the teeth suffering cusp fractures that we now have to repair on a daily basis.

The tooth had a very small occlusal cavity and a new D1 interproximal lesion. I carefully prepared a fully retentive proximal box (which we now call a slot preparation), and a separate occlusal cavity, leaving behind all the sound enamel and dentin between the two mesial cusps. To me, this just made common sense. However, I was failed on my cavity preparation design by the clinical instructor and made to remove all
the sound tooth structure I had so carefully preserved, to make my preparation into an MO, “just like the picture in the textbook.” I continued this decimation of sound tooth structure to ensure I could graduate—and on that day, I went back to my “failing” ways and began preparing amalgam slot preparations.

I have had a chance to review my own work for 35 years and see all the successes and failures. Essentially, I am a skeptic. I like to see proof. However, I am also impatient and cannot wait for a 20-year double-blinded clinical trial to tell me it is OK to change what I was taught. By then, not only would I have missed the train, it would have totally flattened me. So I apply my own thoughts and logic to a problem and then have to be prepared to live with the consequences. One of the most successful long-term restorations have been the early slot preparations. The restorations simply last, because they are not mechanically overloaded by occlusal forces due to their size; and, more importantly, the teeth do not fracture because their biomechanical integrity was not significantly compromised.1

I always question myself regarding materials and techniques that I incorporate into my practice, because I will be faced with the consequences of any wrong decisions. Therefore, I look for solid evidence before making a change. That evidence was, more often than not, staring me in the face in my own patients. I could see things that were not working well or were performing beyond expectations, so I was not too hesitant to try new things when they made sense to me, rather than listening to and being swayed by marketing hype. I have always loved Dr. Gordon Christensen’s comment, “The final test is clinical success.”

I have constantly questioned what I was doing for my patients…and if I was not satisfied with the answers I received, I would go out and try and find better ones. Sometimes with little success. I would then start my own investigations and research, finding mentors who were asking themselves similar questions about MI concepts and collaborating until we got the answers we sought. In the early days of MI in the 1990s, being at the leading edge (and sometimes it felt more like the bleeding edge), was a very uncomfortable place to be, but time is now proving this direction was the correct one to take. At the time, cosmetic dentistry was on the rise and everyone was focusing on the technicalities and the associated financial rewards. From an MI perspective, I watched the evolution of cosmetic dentistry with some trepidation, seeing so much sound tooth structure consigned to the suction trap in the quest for, what often appeared to me, to be a caricature of what a healthy smile should look like. Tooth structure was often sacrificed to meet the requirements of many of the cosmetic material options. MI was often viewed as an annoying background static that was perceived to potentially compromise the financial success of a practice. How could you possibly make money if you didn’t do much; or, even worse, if you did nothing? I particularly like a quote from one of the unsung fathers of true MI, Dr. Bob Berkley: “Patients don’t start buying dentistry until they stop growing cavities.”

**Figure 1:** This lower first molar has small areas of fissure decay highlighted with caries detection dye and the remaining fissures highlighted in yellow. The sub-occlusal oblique transverse ridge (red) runs from the mesio-lingual to the disto-buccal as a subsurface band of solid enamel.² Off this is a web of sound enamel (green) that then supports what is described as the peripheral rim of enamel. Cut an occlusal and you can cause interproximal decay.
Q: What technologies, techniques, and materials have developed over the last 15 years that make practicing MI dentistry possible today versus 20 years ago?

A: In the early days of MI, the focus was primarily on maintaining biomechanical integrity at all levels of tooth preparation. For me, technology went hand in hand with developing MI concepts—initially with the use of loupes, which in the early 1990s were not common in general dentistry. Loupes simply allowed for a better, less invasive preparation. However, it was very difficult back then to find burs small enough to do MI cavity designs. The advent of quality air-abrasion and the incorporation of an operating microscope in 1996 was the turning point for me. Finally, here was a combination of technologies that provided true MI cavity preparations. Early cavity diagnosis using laser-induced fluorescence in the form of the DIAGNOdent (KaVo Dental GmbH; Biberach, Germany) followed shortly after in 1998. Combined with good vision and air abrasion, early lesions could be microscopically dissected and restored, allowing the retention of vital cross-bracing structures like the subocclusal oblique transverse ridge (Fig 1).

The critical factor was magnification. This allowed me to observe what was happening in the depths of fissures and led to me developing a compact disc that helped dentists understand what was being detected by the DIAGNOdent and how to treat it. Dentists who used the DIAGNOdent without magnification and air abrasion often grossly overcut the tooth on their first pass with a high-speed bur and then declared there was nothing there, because they had destroyed all the evidence with the “rotary sledgehammer”!

Predictable, long-term restoration of these early fissure lesions was often disappointing, depending on the resin system that was chosen. In New Zealand, glass ionomer cements (GIC) have been used successfully for many years, and the adoption of a GIC restorative technique has proven to be incredibly successful and predictable. It is based on a technique I researched and developed in conjunction with my mentors that involved many hours on a scanning electron microscope (SEM) and led to an article on a technique for examining the GIC/enamel interface. Suffice to say, the long-term success of these MI restorations continues, with the evidence greeting me at recall exams 10 years later. Seeing is believing (Fig 2)!

Hard/soft tissue lasers have also been a boon to my practice. With a more broad-brush view of MI, any treatment that reduces operative morbidity has to be good. The original Waterlase and then the Waterlase MD (Biolase; Irvine, CA) changed my practice forever. From an MI cosmetic perspec-
tive, I could not offer the combination of laser hard/soft tissue options that were possible unless I was prepared to resort to full-on open flap surgery (Figs 3-6). Equally, lasers have enhanced the delivery of MI periodontal treatment and, having been involved in the research and development of radial firing tips, I have had the pleasure of seeing a revolution in endo-canual debridement.

The next piece in the technology puzzle for me was E4D computer-aided design/computer-assisted manufacturing (CAD/CAM) (D4D Technologies; Richardson, TX) in 2009. The delay wasn’t due to the technology, but rather to the restorative material options. I was never happy with the reports I read on the performance of available porcelains until the advent of lithium disilicate e.max CAD (Ivoclar Vivadent; Amherst, NY), which was the tipping point. Now there was a material that allayed my fear of introducing a restorative technique that could come back and bite me. Colleagues’ stories of CAD crowns, (fabricated from materials before the advent of e.max) failing after five years simply confirmed my hesitance was justified.

I love CAD/CAM dentistry. Because of my MI focus, I often struggled to remove large volumes of sound tooth structure simply to get a crown to stay on a fractured tooth. As a consequence, I tended to place a great number of large, direct posterior composites and became very good at it. Seeing these come in over a 10-year period, the evidence shows they have a very finite performance window, and every time you go back into a tooth, you risk compromising pulpal vitality. I wanted a long-term MI restorative option.

Do we prepare teeth just to make our temporaries last for two weeks? With same-day CAD, this problem disappears and I now very rarely prepare a full crown. Most restorations now are minimally invasive adhesive ceramic inlay/onlay designs. The use of the term “minimally invasive” is in relation to the other option of a full-crown preparation (Figs 7-13).

I often wonder why all these MI technologies are slow to be adopted. They have totally changed my practice for the better, allow me to do what I consider to be better, less invasive dentistry and, as a side effect, have enhanced my income, though that was never the focus—it just happened. When the high-speed handpiece was developed, it became accepted by the profession in a flash, so why not these technologies? Is it fear of the technologies themselves? Are they perceived to be technically demanding? Are we scared to step out of our comfort zone? Do they appear too expensive? On that note, I often wonder why U.S. dentists struggle with the perceived cost of technologies when they are profitable for me, even

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**Figure 4:** Using the Waterlase MD, closed flap bony crown lengthening was performed to attain the desired clinical crown length and reestablish the correct biological width. Potential impingement of the fraenum on the stability of the gingival crest was relieved at the same time.

**Figure 5:** Image 10 days after laser surgery. This type of result cannot be achieved for the patient with conventional open flap surgery in a similar time span. Healing times are significantly reduced as is overall surgical morbidity.

**Figure 6:** This image one year after laser surgery shows how predictable and stable the hard and soft tissue surgery has been.
when purchased at significantly more cost with the New Zealand dollar (otherwise known as the “South Pacific peso”). Sadly, many focus on the cost, rather than the return on investment. These technologies are mature and simply work, so I suppose it is more the issue that some dentists are just not yet ready for the technologies.

To look at MI dentistry from a slightly different perspective, we should really rename the whole concept, “Maximum Intervention, Minimal Invasion.” The ultimate in MI is to do nothing, and this involves treating the disease, not the cavities, which are simply symptoms of the biofilm disease we call caries. Yes, it is difficult to treat, and relies on patient compliance and lifestyle choices, but simply filling holes does not make the disease go away. It reminds me of Einstein’s saying that, “the height of insanity is doing the same thing over and over and expecting a different result.” Looking back at my practice, that is what I was effectively doing for the first half of my career. Drilling and filling, even at the MI level, did nothing to change my patients’ disease outcomes. I shudder when I read articles that state “there was no other option but to place crowns to treat the caries in the teeth.” Crowning teeth does not treat caries—caries is a biofilm disease and porcelain does not do anything to bacteria!

The big practice changer for me came in the form of a caries management protocol based on pH management. The science behind this is substantial and convincing. I had tried all sorts of preventive concepts over the years with limited success. Finally, here was a systematic approach to trying to train a biofilm back to health and promote remineralization in the form of the Carifree system (Oral Biotech; Albany, OR). Rather than fight Mother Nature and try to kill all the bugs, which we all know is doomed to failure, the goal is to train a diseased biofilm back to health. Suddenly I was also a “doctor of dental health” rather than a highly skilled dental technician and began to have a success I had never known before.

As a result, I was challenged to improve my and my team’s communication skills, not to close a big treatment plan, but to help patients grasp their disease problem and help them change things. When this happens, patients feel comfortable investing in quality dentistry because they understand it will last, rather than it failing from more continued decay in the not-too-distant future.

All the techniques, materials, and technologies I have incorporated over the past 15 years remain fundamental to my delivery of comprehensive MI dentistry to my patients. New technologies are constantly being explored and developed and the fun comes in assessing whether they are going to be a step forward, or simply an interesting sideways development. Care is needed to ensure we don’t end up purchasing

Figure 7: This image shows a 20-year-old attempt at MI adhesive porcelain. The porcelain was fused to a hydroformed gold base that was then bonded to the tooth. The tooth/gold bond has survived for 20 years however, the feldspathic porcelain was inherently too weak to survive.

Figure 8: The new preparation for an adhesive E4D CAD/CAM e.max restoration. Temporization for two weeks would be difficult, but same-day CAD/CAM alleviated this issue. The adhesive ceramic option means the preparation is significantly more constrained compared to a preparation requiring cementation utilizing a full ferrule for retention.
something that is a fancier “me, too” rather than a true step up. Often there is what I call a “stickiness factor” (the material or technology may, on first look, appear good, or even really sexy, but the reality is you end up not using it because it is too time consuming or just plain frustrating to use).

Q: What techniques and materials do you use in your everyday practice to bring the best of MI dentistry to your patients?

A: Patients initially go through a caries risk assessment and if anything pops up, a diagnosis of the health of their biofilm using the bioluminescence Cari-screen meter (Oral Biotech). When required, the caries problem is addressed and treatment options modified to meet patient expectations and their current risk profile. This may also involve placing GIC restorations as an interim restorative option until the biofilm disease has been controlled.

Air abrasion remains a cornerstone of my practice, not only for MI restorations, but as part of my adhesive protocol. From all the SEM evidence I have been able to produce over several years of research, there is nothing that leaves the tooth surface in such good state for all current adhesive bonding protocols, so my Kreativ Mach 5 (San Diego, CA) from 1997 gets a daily workout and still continues to function well.

Glass ionomers and composites remain a cornerstone for me as MI restorative materials and combine well in the closed sandwich technique for restoring very deep cavities. Combining the closed sandwich technique with silver diamine fluoride is something recent that is proving to be very successful at maintaining pulpal vitality in deep cavities. The use of autocure GIC as a preventive restoration and sealant has proven to be one of the most successful restorative techniques I have ever adopted. However, the success lies in the detail of the technique; I will be covering this in one of my lectures at the AACD Annual Scientific Session next May.

Minimally invasive adhesive ceramics utilizing E4D CAD/CAM and e.max CAD is now one of the cornerstones of the restorative side of my practice; I just wish e.max had come along sooner in my career.

Soft tissue management and perio treatment has changed significantly since I introduced lasers. Once again, it is the combination of magnification and the technology that allows me to provide treatment options and outcomes that are not easily achieved with more conventional approaches.

Q: What is important now for cosmetic dentists to understand when it comes to MI dentistry?

From my perspective, MI is an all-encompassing concept and philosophy that extends to involve all dental specialties.
A: In one sentence? Manage the disease first. The perception is that there is no income in this approach. I beg to differ. Once the disease is controlled, patients will invest in their mouths; we have to take a longer view than just this week’s turnover. Of course there are MI treatments we can do that are not totally reliant on excellent oral health—in fact, they help reduce the potential for a diseased biofilm to harm the teeth, but extensive MI restorative options should be backed up by effective biofilm management.

Q: Are there differences in approach to MI dentistry in the United States versus the rest of the world?

A: Probably the most significant would be the accurate utilization of glass ionomers. They have been effectively used in New Zealand and Australia for more than 30 years. Their poor reputation in the U.S. is possibly due to a lack of understanding regarding their effective applications. They have been touted as the cure-all in high-risk sites and mouths (when everything else has failed, slop in a GIC). Then we are faced with the clinical reality, that the GIC failed too, so therefore it is no good. Spending time on DentalTown was an eye-opener for me. Dentists would ask questions about GICs and someone would chime in with some advice that I could only say was misguided at best. Something as simple as removing the cavity preparation smear layer with cavity conditioner was discounted as a waste of time. Just squirt the GIC straight in, it is quicker! Then they wondered why the restoration failed. Nothing sticks to a smear layer.

Q: What future developments do you see that will aid our members in practicing MI cosmetic dentistry?

A: Sometimes it is difficult to predict what the next breakthrough is going to be or what aspect of dentistry it is going to be focused on. There are already several technology developments out there that mainstream dentistry is struggling to adopt. Air abrasion, lasers, same-day CAD/CAM, digital imaging cavity detection, digital imaging shade selection, continuing advances in biofilm management to name a few, all still struggle to gain a significant foothold in our profession and I often wonder why this is, because I simply could not practice without them. I recall a comment my assistant, who has been in dentistry for 35 years, made recently when I was able to save a traumatically fractured tooth through the ability to do a laser closed flap bony crown lengthening: “I could not go back to assist in a practice that didn’t have all the ‘toys’ we have. That tooth would have been in the bucket at my last practice.”

Figure 11: We negotiated the removal of half the thickness of the facial enamel to allow room to add something back on without increasing the facial thickness of the tooth.

Figure 12: Cloned e.max CAD low translucency thin veneer that was milled to .3 to .45-mm thickness.
There is so much already out there. We don’t really need much more. We just need to start using what is already here. Who purchased the original iPhone? Did they hesitate because they knew something better would come along soon? So they waited for the iPhone 2. Oops. iPhone 5 is now coming. That doesn’t mean the previous iterations of the iPhone are bad. You have to make the leap at some point, don’t hesitate, the current technologies will work for you, they do for me. The same goes for our material options—we now have some very good choices out there.

Q. What are you looking forward to when you address the Aacd in Washington, D.C., in May?

A: I know I will be in the company of many like-minded colleagues who strive to do the very best for their patients and are constantly honing their skills. I love being in the presence and company of “eagles.” That is why they belong to the AACD. I look forward to sharing some of my thoughts and ideas based on 35 years of practice and clinically based research, to help them raise their awareness of the impact embracing MI concepts and treatment modalities can have on their practices. Sadly, in our profession, one of the realities is that time is also money. Efficiencies in patient assessment and restorative techniques has an upside to this equation. Hopefully I will also be able to share some of the “tricks” and products that can make that little bit of difference. For some, these lectures will appear to be “common sense” dentistry and to others they have the potential to be, as one dentist recently described them, “a professional epiphany.”

References

