Lasers have been used in different medical fields for many years. Traditionally they have been used in many treatments, notably eye surgery and hair removal. The technology is in an established aspect of modern dentistry and is widely used in Europe and the U.S. Dr. Graeme Milicich had a chance to speak to Graeme Milicich, who is a fellow, diplomat, and founding board member of the World Institute of Laser Dentistry. This is a feat that is normally reserved for dentists, and the National Institute for Laser Dentistry (WILD), prior to the recent International Congress in Stockholm in Sweden.

Anke Schieman: In a nut shell, what are the benefits of using laser in dental clinical today?

Graeme Milicich: Lasers have many applications in clinical dentistry. My research in the last four years focused on the clinical applications of hard tissue lasers. The broad range of laser applications has benefits for both the patient and the dentist. Many hard and soft tissue laser treatments are much less invasive compared with conventional approaches. I do not think there is another piece of technology in dentistry that has the ability Erbium lasers to have soft tissue, bone, and tooth structure, simply by changing laser-operating parameters.

What is the advantage of lasers used as instruments, and are there limits to what a laser can do?

Yes, there are some limitations as to what can be done with a laser, like the removal of metal restorations and crowns. But if you consider the totality of the types of treatments offered by general dentists, these limitations are far less compared to conventional rotary instrumentation. For example, you could run into problems with soft tissue contours or bone levels as associated with a deep cavity while cutting tooth structure. With a laser, you can remove both bone and soft tissue by simply changing a setting, and are far more likely to complete the procedure in one appoint- ment—something that cannot really be done with a high-speed drill. Even then, what can be done with a drill, scalpel, or bone bur can also be done with a laser. Additionally, many patients have a fear of dentistry based on the sounds and vibrations associated with rotary instruments. These sensations do not occur with the laser, meaning the patients find treatment much more acceptable.

What role does laser fluorescence detection currently play in the prevention of oral diseases?

With the advent of the kavo DIAGNOdent more than ten years ago, the first general dental procedure was developed. It is associated with new technology, it had to be understood first, in order to achieve the best results.

In order to provide patients with accurate treatment recommendations based on the results of such a procedure, an understanding of minimally invasive concepts is essential. Otherwise, the profession can be open to claims of over-treatment. These charges often derive from a lack of understanding of the technology, its accurate application, and the concepts and applications of minimally invasive techniques. Often, astute clinicians are at the forefront of implementation of new technology and techniques, and the research literature struggles to keep up with the clinical pioneers. This leads to a period of a shortage of validation for what eventually becomes a new and accepted standard of care. Further developments in the field are occurring and, as they filter into general practice, the standards of diagnosis will continue to improve. For new diagnostic techniques to be readily implemented in general practice, it has to be both cost effective and time efficient.

What are the chances of treating peri-implantitis with lasers?

There are many case studies showing excellent results when treating peri-implantitis with lasers. However, use for debridement and disinfection gives the competent clinician a tool that previously wasn't available. The laser is used to safely remove around implants with little risk of damage to the implant. Personally, I have only treated one case of peri-implantitis so far, and it was a complete success.

The use of laser in fields like endodontics or periodontology is highly controversial, but what are the main issues here?

Once again, competent laser clinicians are ahead of the research in these fields. Clinical results are being achieved that are now only beginning to be validated by research, and until the research results are available, use of lasers in these fields is going to remain controversial for many. Those that are using lasers and are observing the outcomes, have little doubt as to the efficacy of their treatments. Personally, I have been involved in research using the Waterlase diode laser. The ability for complete debridement of the canals follows the same procedure. The ability for complete debridement of the canals follows using rotational firing tips in a non-ablative mode is significant and advances the issues of air and fluid entrapment at the apex that are associated with conventional techniques. The Waterlase is used for canal debridement and rinsing.

In your FDI lecture you referred to lasers associated with laser therapy. Can you give our readers a brief history and explain these concepts?

The most common complaints from a new user is that it will not cut fast enough. The most significant contributor to slow ablation rates is the user, not the technology. The single biggest hurdle a dentist faces is the speed of the laser. The main difference is the difference between rotating instrumentation and lasers. A new laser dentist can become competent in a very short time. If these concepts the laser is well taught, then the new user will become frustrated and may fail to integrate their new laser into their treatment regimens.

The first concept is that lasers are end cutting. We have all become very competent using rotary instrumentation and have developed reflex motions as a result. The natural tendency is to apply these ‘reflexes’ when using a laser and this leads to frustration for the new user. When using a high speed hand piece, you assume the bur laterally to extend a cut. This does not work with a laser because the laser must cut in a side cutting motion. Therefore, the operator needs to learn a new way of doing things. Personally, it wasn’t available. The laser is safe to use around implants with little risk of damage to the implant. Personally, I have only treated one case of peri-implantitis so far, and it was a complete success.

The use of laser in fields like endodontics or periodontology is highly controversial, but what are the main issues here?

The second concept is that slow is fast. Once again, this concept is contrary to what our reflex motions associated with using high-speed hand pieces. We tend to use a fast painting motion of the laser. This is slow. The ability of the laser to contour a cavity. Exactly the opposite applies when using a laser. Ablation rates are slowed by this rapid painting motion, and initially it requires a mental awareness to slow the motion of the tip, to allow ablation to occur. As competence increases, this phenomenon is used to control ablation rates, without having to alter laser settings, by increasing or decreasing the motion of the tip.

The third concept is focusing and defocusing the beam, to alter ablation rates. For example, having to change power settings on the laser. This technique, in combination with slowing or speeding up the motion of the tip, allows the operator to finesse ablation rates to create very smooth contours.

The final concept is the clinically observable ablation threshold. Many machines focus on power settings and how far the tip should be from the surface. The answer is, it depends on what they want to do. Absolute distances in relation to operating parameters are impossible to give because there are so many variables involved, including the tip being used, the state of the tip, the air/water ratios, and the surface being ablated.

As a tip moves towards the tooth, it reaches a point where the operator can begin to see the commencement of ablation. This then gives a reference maximum operating distance in relation to the current settings and tip being used. New users are taught to start out of focus and move towards the tooth until the clinically observable ablation threshold is reached. This distance can range over several millimeters, depending on the various parameters. Understanding the concept helps new users avoid inadvertent high fluence effects at the ablation surface.

There are two other issues that will be dealt with as separate topics in the lecture in regard to ablation rates in enamel. This is the area that new users often struggle with, because they tend to use rotary cutting movements with an end-cutting motion. Firstly, because laser ablation is a non-contact technique, magnification is essential. Secondly, enamel ablation rates are related to the orientation of the long axis of the enamel prisms in relation to the plane of the ablation face. Abrasion rates are 40 per cent greater when enamel prisms are ablated from their sides, rather than on their ends. This requires an understanding of the orienta- tion of the long axis of enamel prism so that the cutting direction is along a tooth. The culmination of this understanding is epitomised in the time it takes a new user or a competent laserclinician to cut a slot preparation, with a new user often taking more than three times as long to complete the same procedure.

Recent research on shorter wavelength lasers or so-called blue lasers has shown them to be effective in diagnostic and treatment planning in the years to come?

Many dentists focused on minimizing or eliminating the use of laser fluorescence in the diagnosis of demineralisation of teeth due to plaque. With these new applications, such companies may see increased resistance to the technology, but will have multiple, switchable frequencies that will allow one to accomplish varied tasks that would be impossible with lasers.

As uptake of laser technology increases, costs will decrease, making lasers more affordable and accessible to more of the profession.

Do you expect lasers to be an essential part in every dental practice in 10 to 15 years?

The multiple applications of lasers are only going to expand in the future. At the moment, the lasers with the most clinical applications in one unit are the Erbium family, and many dentists have embraced this technology and are constantly expanding its clinical applications. We hope to have laser technology in 60 years to the initial introduction of the high-speed hand piece, with laser technology in 60 years to the initial introduction of the high-speed hand piece, with laser technology having more significant resistance to the technology, and it took over 10 years before it was readily accepted into general practice. Lasers have had a slower journey, mainly because of the need for advanced technology to make them more applicable in the field of dentistry and the associated research and development costs that are reflected in the price of lasers.

Thank you very much for the interview.