

# Laser dentistry: the ideal solution for faster treatment of more patients

By Stef Harley

*Currently many dental surgeries are considering how they can increase practice revenue and patient turn-over. The pressures of the global economic downturn have led patients to be cautious about spending; treatment acceptance is lower and waiting rooms are emptier than before. To treat more patients per day, surgeries need to streamline dental procedures and offer more than competitors. The latest in dental laser technologies may well be the answer to the recession for many practices. Offering superior treatment speed, increased clinical quality and a positive experience for patient and dental staff alike, dental lasers have come a long way from the situation where many dentists still had common misconceptions about lasers.*



It may be true that some laser systems, which deliver the laser light to the tooth through an optical fibre, have limitations because of the relatively low speed at which the treatment can be carried out. To protect the expensive fibre, laser energy must indeed be kept low, often at the expense of treatment speed and efficiency. However, nowadays laser systems that utilise an articulated arm and are supported by advanced technology, such as VSP technology, can deliver laser energy much more efficiently, without compromising on speed. Such lasers achieve optical drilling speeds of up to 1.6 times higher than conventional high speed burs [1].

## Choice of laser source

When the expansion of a dental

practice by means of installing a dental laser system is being considered, the right choice of laser source is of course essential. Erbium lasers have long been recognised as the optimal dental lasers for effective, precise and minimally-invasive hard dental tissue treatments [2]. Of all infrared lasers, they exhibit the highest absorption in water and hydroxyapatite, and are thus ideally suited for cold optical drilling in enamel, dentine and composite fillings. A recent study published in the *Journal of Oral Laser Applications* [3], states that an Er:YAG laser delivered through an articulated arm, cuts three times faster through dentine and 4.2 times faster through enamel, than an Er,Cr:YSGG laser delivered through an optical fibre. These results were obtained using a novel,

accurate and reproducible method to measure laser ablation speeds under realistic conditions, mirroring the laser treatments manually administered by a dental practitioner. According to the authors of the study, the measured differences in treatment speed are the result of differences in the laser wavelengths, pulse duration and shape of the laser pulses. Because of the differences in wavelength, Er:YAG is absorbed three times better in hard dental tissue than Er,Cr:YSGG. This essentially means that the Er:YAG removes more hard tissue at the same laser power settings, thus leading to faster procedures. In addition, to ensure that the patient experience of laser use for hard dental tissue treatments is positive, it is important that as little as possible heat that is created

by the laser energy be diffused into the surrounding tissue. The determining factor for this is the laser pulse duration. If the laser energy can be delivered to the target tissue in a very short time span, then the energy cannot escape from the ablated tissue, and so cold optical drilling is achieved. This is not only essential to maintain patient comfort but also determines optical drilling speed. In this respect Er:YAG lasers are at an advantage because they can generate very short, 50 microsecond pulse durations. Measurements using the Er,Cr:YSGG laser showed that, although the minimum pulse duration that can be selected is nominally 140 microseconds, in fact, on measurement, the generated laser pulses are found to be technically limited to 500 microseconds. A final consideration that indirectly contributes to higher optical drilling speeds is the shape of the laser pulse. Ideally, laser pulses should be square-shaped, without a long build up followed by a decrease in laser power. This ensures that laser power remains constant within the pulse. Its effect on the tissue does not change from that of cold optical drilling to that of drilling regimes with a thermal element; this would lead to inefficiency. The Er:YAG laser system used in the study provided practically square pulses, while the Er,Cr:YSGG system produced pulses with a longer decline in laser power throughout the pulse. According



The AT Fidelis laser system.

this difference in pulse shape also contributed to the measured difference in optical drilling speeds. By carrying out procedures such as cavity preparations and caries removal in several minutes less time, it is clear that eventually more patients can be treated on a daily basis.

## Advantages for patients

In 90% of cases, patients feel no discomfort at all during Er:YAG laser treatments [4]. Procedures can frequently be performed without anaesthesia. This eliminates considerable waiting time while the anaesthetic takes effect. With improved patient comfort and reduced anxiety (no needles, no noise, no vibration, no numbness), the stress for both dentist and supporting personnel is also minimised. When no anaesthesia is used, patients can receive treatments in all four quadrants during the same appointment. Fewer follow-up appointments and faster treatments not only mean more, free chair time, but also happier patients. Satisfied patients are more likely to spread the word about comfortable and fast treatments, which will increase the number of people who visit the practice. Secondly, optical laser drilling does not leave a smear layer on the prepared tooth surface in the way mechanical burs do [5]. In most cases acid etching will not be required, eliminating even more procedure time.

There are dental laser systems on the market, such as the AT Fidelis from Fotona, that combine two laser sources to provide a comprehensive dental treatment platform. These laser systems allow the dentist to

perform both hard and soft dental tissue procedures, often in one session. They even allow dentists to perform procedures that would have otherwise needed to be referred elsewhere. After relevant clinical training, these systems will allow dentists to expand their services to include treatment options for periodontal disease, osseous surgery and many other procedures. This allows surgeries to fill gaps in the schedule with new, high-revenue generating procedures.

Because they allow higher patient turn-over through faster procedures, more patient referrals and added exposure to the dental practice, it is easy to see that lasers are indispensable to a modern dental practice in these troubled economic times.

## References

1. Miletic I, Baraba A, Krmek S, Bozec Z, Anic I. Comparison between Er:YAG laser and high speed hand-piece: prepared cavity volumes and ablation speed rate in enamel and dentin *in vitro*. Temperature changes and SEM observations associated with Er:YAG preparations Laser Surg Med 2008.
2. R. Hibst. Lasers for Caries Removal and Cavity Preparation: State of the Art and Future Directions. J Oral Laser Appl 2002; 2: 203-211.
3. Perhavec T, Diaci J. Comparison of Er:YAG and Er,Cr:YSGG Dental Lasers. J. Oral Laser Appl 2008; 8: 87-94
4. Matsumoto K, Nakamura Y, Mazeki K, Kimura Y. Clinical dental application of Er:YAG laser for Class V cavity preparation. J Clin Laser Med Surg 1996; 14: 123-127
5. Bader C, Krejci I. Indications and limitations of Er:YAG laser applications in dentistry. Am J Dent 2006; 19: 178-186.

## The author

Stef Harley  
Fotona d.d.  
Ljubljana, Slovenia  
Bingo 100171

More info...

[www.worlddental-online.com](http://www.worlddental-online.com) & search 100171



## Some misconceptions about laser dentistry

### Hard tissue lasers cut slower than high speed burs.

This can be true for laser systems that deliver the laser beam through an optical fibre delivery system. To protect the expensive fibre, the laser energy must be kept low. But laser systems such as Fotona's Fidelis III range utilise an articulated arm and advanced technological solutions, such as VSP Technology, that allow the laser to deliver much more energy for efficient laser drilling. This means that these lasers can cut at comparable and higher speeds than conventional high speed burs. In fact a recent paper has described the use of a very novel and accurate way to determine ablation speeds. The study shows that a hard tissue Er:YAG laser delivered through an articulated arm cuts 3.7 times faster through dentine and five times faster through enamel than an Er,Cr:YSGG laser delivered through an optical fibre (Waterlase MD, Biolase). Another study determined that the same Er:YAG laser delivers drilling (ablation) speeds that were higher than that of a high speed bur.

### Lasers have limited uses; some work strictly on soft tissue, others only on hard tissue.

This is not entirely true. Laser systems that incorporate two laser types can work very effectively on both soft and hard tissue. This is because each laser's wavelength is ideally suited to work on each tissue type. For example, Fotona's AT Fidelis is indicated for more than 45 procedures, virtually replacing the dentist's entire traditional toolkit with a system offering faster, more efficient and effective treatments. In addition, many treatments simply cannot be performed with the conventional toolkit.

### Lasers are 100% painless.

Most patients (90%) feel no discomfort at all during Er:YAG laser treatments. Fidelis lasers are thus predominantly used without anaesthesia, but certain situations and certain patients require local anaesthesia. A topical anaesthetic suffices for some soft tissue procedures; larger hard tissue procedures may require a local injection. Nevertheless, patient comfort is dramatically improved (no needles, no noise, no vibration, no numbness), thus reducing dentist and staff stress. Where no anaesthesia is used, patients can receive treatments in all four quadrants during the same appointment. Fewer appointments and faster treatments mean more free chair time.

### Lasers are a bad investment.

Lasers are not inexpensive, as is usually the case with most investments in developments with future earning potential. If dentists understand the benefits of lasers, the positive return on any investment will be very clear. With a reduced need for anaesthesia, more treatments in multiple quadrants can be carried out, during shorter visits, thus increasing per-visit production. Dual laser systems allow the dentist to treat more conditions efficiently and less invasively, even conditions that were previously unable to be treated. The combination of increased patient referrals and added exposure as a result of the practice offering more than its competitors, means that lasers are now indispensable in modern practices.

## References

1. Diaci J. J Laser Health Academy 2/1 2008. <http://www.laserand-health.com>
2. Grgurevič J *et al.* Lasers Surg Med 2005; 36: 347-350.
3. Matsumoto K *et al.* J Clin Laser Med Surg 1996; 14: 123-127.