GUEST EDITORIAL

The incredible applications of
Drill-less Dentistry
Give your patients a truly ‘painless’ experience with air abrasion and laser technologies

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While air abrasion technology has been around since the 1950s, only 20% of US dentists have adopted drill-less technology and most have done so only over the past 10 years. Many dentists voiced objection to the no-touch technique and the ‘mess’ of air abrasion. In addition, coping with the overspray often frustrated even the most highly experienced practitioner. The aluminum oxide could abrade gingival tissues causing hemorrhage and restorative complications at the gingival margins. Attempting subgingival coronal or root caries treatment would require gingivectomy to fully expose the extent of the lesion before beginning treatment. A few cases of air emphysema were reported as the excessive air pressures broke through attachment tissues and infiltrated the facial tissue spaces. Even the most cautious and meticulous practitioners found tissue protection devices and methods cumbersome and time consuming. Perhaps the number one objection to the air abrasion technique was the overall slowness of cutting speed when compared to the high-speed turbines.

Fast forward to the mid ’90s. Laser technology was introduced into dentistry and manufacturers of the earliest lasers (CO₂, Argon, and Nd:YAG lasers) had visions that these wavelengths could eventually be used in cavity preparation and be the ONE LASER dentists could use on both hard and soft tissue. Unfortunately, the energy generated by the earlier wavelengths produced too much heat and either caused cracking of the dental hard tissues or potential necrosis of the pulpal tissues. The Diode laser (American Dental Technologies) introduced in 1996, while becoming the most popular soft-tissue wavelength has little interaction with dental hard tissues.

In 1998, the Erbium YAG lasers were introduced to the US dental market. These were at first thought of as hard-tissue only. Manufacturers found this particular wavelength to be one of the most technically challenging to engineer and deliver to the target tissue (tooth structure). With most of the technical difficulties now in the past, there are several Erbium lasers on the market that are challenging air abrasion as the preferred method of conservative cavity preparation.

Cutting Speed

Unlike most burs and diamonds, which have side as well as end cutting capability, the erbium lasers are essentially end cutting, which somewhat limits the speed of tooth structure removal. Many Erbium laser operators report that they frequently use both air abrasion and the laser for a particular preparation. Since AA cuts enamel faster, it may be advantageous in many cases to begin with it and follow with the laser on the dentin and soft decay. However, the advantages over traditional rotary instrumentation are that both the Erbium laser and air abrasion are not known to be capable of causing microfractures of the enamel. Since causing no harm is a goal of restorative treatment, choosing a new method of preparation that is slower and better is in the patient’s best interest.

Laser Technique

Erbium YAG lasers have the unique property of being most interactive with both water and hydroxyapatite molecules. This laser tissue interaction makes this wavelength almost ideal for the removal of tooth structure. The Erbium wavelength can ablate the enamel and dentin directly causing vaporization of the structure. The additional interaction with water molecules makes this process more efficient. Besides the small water component of the dental structures, the laser unit supplies a stream of water to the end of the fiberoptic delivery system to facilitate the laser-tooth interaction.

These additional water molecules are broken up by the laser interaction and are propelled against the tooth structure. This results in almost a “power washing” effect. The additional water also helps keep the ablated tooth structure from becoming over-heated.

Before beginning to lase, the operator touches the tooth with the tip and then withdraws approximately 1mm. The result is a ‘no-touch’ method of structure removal. Working at a less than 90-degree angle to the enamel seems to facilitate the vaporization rate. Dentin is vaporized more quickly than enamel making the initial penetration appear slow at first. Demineralized structures (decal) are quickly ablated.

Perhaps a major advantage of Erbium ablation is the debridement of the bacteria infecting the lesion. The water content of the bacterial walls is boiled away effectively sterilizing well into the dentin. This

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laser effect may be the most valuable therapeutic action of any technique ever employed in the treatment of caries.

**Analgesia**
Both air abrasion as well as Erbium laser technique can be used 80-90% of the time without the need for local anesthesia. Both technologies are essentially ‘no-touch’ and generate little to no heat to stimulate the pain nerve fibers. In the case of the laser, there appears to be an inherent analgesic effect which in theory lessens the ability of nerve fibers to conduct pain by interfering with the sodium ion permeability of the cell membrane.

It has long been understood that conserving marginal and transverse ridges will help maintain the inherent strength of teeth. The laser will be an aid in preserving these structures.

**Cavity Design**
Caries restoration often will consist of a number of “cavities” on a particular surface, often not connected in the preparation as in the G.V. Black System. Both the Erbium laser and air abrasion are ideal instruments to accomplish this methodology of restorative treatment. Cavity size, instead of being determined by bur size or ideology will dictate a custom prescription for each individual tooth. Rotary instruments of any size only cause microfracturing, which usually compromises the integrity of the restoratives and tooth structure for the future.

**Bondability**
Both mechanical bonding of resin systems and chemical bonding for glass ionomers require completely clean and non-contaminated surfaces for maximum bond strength and sealability related to long term clinical success.

Air abrasion leaves enamel in this ideal state, but the dentin appears to have “flattened” collagen fibers covering dentinal tubules on SEM views. Thus dentin must be etched in order to allow better resin penetration. The Erbium treated dentin appears to have the hydroxyapatite “dissolved” away from the collagen matrix apparently making an almost ideal substrate for bonding. The oil contamination and smear layers inherent in the rotary technique are no longer complicating factors for the “Bondodontist” to deal with.

**Endodontics**
Among the latest FDA approvals for Erbium is the use in root canal therapy. Thin fibers are introduced into mechanically opened preparations and the tissue is ablated while decontaminating the canal of microorganisms using only distilled water! All of the mechanical trauma leading to root fracture may make this the method of choice as we gain experience in this technique.

In addition, it is not necessary to introduce potentially toxic solutions in order to achieve canal debridement.

**Soft Tissue**
The soft tissue-only lasers have been purchased by approximately 10% of the US dental offices. It is often heard that even the most progressive dentists have been waiting for a laser that could do it all! Erbium YAG could turn out to be that wavelength! At this time, it has only limited capability to coagulate or to treat periodontal pockets, but it has the capability of making incisions in commonly performed treatments such as gingival troughing, gingivectomy and gingivoplasty as well as lesion removal (fibroma).

**Marketability—medical model**
It is interesting to note that of the medical specialties that have embraced laser treatment, none have retreated from this trend. In an era where the two-tier system of care has become the rule throughout the country, it is more necessary than ever that practices find their niche in order to garner its share of the fee-for-service pie. It would be shortsighted for dental practices to continue to look the other way when our patient bases have already been saturated by medical specialties’ advertisements extolling the benefits of laser treatments for eyes, skin, and just about every other human tissue except teeth!

If you would like more information on the CaviLase®, or the DioLase® lasers, contact American Dental Technologies, call 877-793-3717 or visit the company’s website: www.americandentaltech.com.

**Access**
Before beginning cavity preparation, a thorough diagnosis and caries mapping needs to take place. This can be accomplished only partially with radiographs as most virgin decay presents in hidden areas throughout the pit and fissure system of the enamel. Caries detection dies are a good visual aid and have been found to be more accurate an indicator of caries than the tactile feel of hand instruments. New diagnostic lasers (Diagnodent by KaVo) are a far more accurate and scientific method of caries mapping.

**Drill-less systems can be used together, separately**
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