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MULTI-PURPOSE LASER OFFERS UNIQUE APPROACH TO RESTORATIVE DENTISTRY

by Ronald E. Goldstein, DDS

Few professions have worked as hard as dentistry to convince the public of the value of its services and especially to make these services as attractive as possible. Of no minor importance is the realization that patients want and appreciate dentistry's efforts to make dental visits more pleasant. Efforts to communicate advancement in dentistry is seen in written advertisements, as well as television coverage of just how painless and high-tech a visit to the dentist has become. Helping improve the public's perception that dentistry has come a long way since the "old fashioned drill" is the addition of lasers to the dentists' armamentarium.

Our practice has had an association with various dental lasers since they were first introduced to dentistry. At one time or another we have essentially incorporated most wave lengths into patient treatment. We have used CO₂, Nd:YAG and Diode lasers for soft tissue applications and use Argon technology for curing and power bleaching. Each have had unique features that allowed us to improve the manner in which we do dentistry.

Recently, we became interested in a totally new wavelength which could be used for dental purposes, the Er, Cr:YSGG wavelength (2780nm), found in the Millennium Laser (Biolase Technology, Inc., San Clemente, CA.) This unique crystal generates photons through a fiber delivery system emitting from a

handpiece with a sapphire crystal that is bathed in an air and water atomization spray. The system emits photons at a wavelength of 2780nm and a repetition rate of 20Hz. The power output can vary from zero to six watts. The beam spot size is 0.442mm squared with the use of the 750-micrometer fiber. There are several unique properties possessed by this system that make it entirely appropriate for dental practice.

A major feature of the Er, Cr:YSGG system includes a previously unknown method of cutting tissues, called laser Hydrokinetics. Hydrokinetics is the process of removing biocalcified tissue through optimized absorption of Er, Cr:YSGG laser energy by atomized water particles that result in energized microparticles capable of precise tissue cutting. Water particles are the energized agent which remove the target tissue.

If the power of the laser is lowered significantly, and most or all of the water is eliminated while applying a small amount of air co-axially to the tip for patient comfort, the laser can usually effectively cut soft tissue without anesthesia. There is seldom discomfort because the fluid at the cellular level absorbs the energy and not the nerve endings. There is photo-ablation, truly a vaporization of the cells. Where other fiber-delivered soft tissue lasers need to be initiated or enhanced at the tip to make them effective (essentially making the tip a hot knife) the Er, Cr:YSGG laser needs no initiation at the tip due to its absorption into water.

Although the original delivery system with the Er, Cr:YSGG laser did not have replaceable tips and did not rotate, the new MVP-HS (Micro Versa Prep – HydroKinetic) delivery system has remedied these issues. The MVP has the look

and feel of a traditional dental handpiece, rotates 360 degrees, has a range of disposable tip sizes (400-750 micron) that can be used for different procedures and can be autoclaved.

As previously stated, a major advantage of the Er, Cr:YSGG laser is the ability to be able to treat both hard and soft tissues with the same instrument, thus saving time and providing the patient with a highly efficient dual procedure. Presented here are two cases using the Er, Cr:YSGG in its dual capacity treating hard and soft tissue. No anesthesia was required in either case. One of the advantages of using this laser in its hard tissue mode is that tooth structure can be preserved by eliminating only the diseased portion and not causing microfractures. The Er, Cr:YSGG laser leaves no smear layer, eliminating the need to etch. However, if acid is used in conjunction, a stronger bond is developed than using either one alone.

Case One: The first case was a geriatric patient with advanced caries in need of a disto-occlusal restoration on tooth (#28). Figure 1 shows the position of the laser being used in the operatory.

Figure 2. The laser making the preparation. Notice that the device resembles a common dental handpiece. After the laser was used to prepare the tooth, it was noted that the gingival tissue had grown into the disto-gingival defect.

Figure 3. The hard tissue was cut using the following dosimetries:

AIR

POWER

WATER

Enamel	50%	6 watts	50%
			(300 mj)
Dentin	40%	4 watts	40%
			(200 mj)
Carious Lesion	20%	2 watts	20%
			(100 mj)

The Er, Cr:YSGG laser incorporates presets, and it is easy to go from one tissue dosimetry to another by pushing one button.

Figure 4. The laser being used in the soft tissue mode with 14% air and 1.25 watts of power and no water. Occasionally, 5-7% water might be used for patient comfort. However, in this case, due to its hyperemic nature, no water was used.

Figure 5. The disto-gingival margin is now much easier to see and finish.

Figure 6. The adjacent teeth, (#26 and #27) are prepared using the dentin setting for hard tissue removal. Again, the patient felt no sensitivity.

Figure 7. Undercuts and precision cutting are easy to obtain with the new handpiece.

Figure 8. The final restoration of the right lateral (#26), cuspid (#27) and first bicuspid (#28) restored with hybrid composite resin.

Case Two:

Figure A. A disto-lingual carious defect in the upper left lateral incisor (#10) and incisal edge of the cuspid (#11). The upper teeth will eventually be treated with porcelain laminates that will overlap the incisal edges.

Figure B. The Er, Cr:YSGG system was used on the enamel setting to partially prepare the lingual lesion. The laser is readjusted to the soft tissue setting to remove the excess tissue.

Figure C. Once the tissue is removed, the laser is instantly readjusted to the dentin setting to finish the preparation and the defect is bonded with a hybrid composite resin.

Figure D. Seven days post-operative. Notice how well the tissue has healed.

DISCUSSION:

First the high-speed drill, then air abrasion, and now the "cutting" laser together add up to a complete range of technology to prepare teeth in a precise and many times painless method. What is exciting in this newest of lasers, is the ability of the Er, Cr:YSGG laser to be useful in preparing virtually any classification of cavities and at the same time to be

immediately available to help treat an adjunctive soft tissue problem that may be discovered.

Approximately 50% of the U.S. population fail to see a dentist routinely. This is partially caused by the perception that dentistry is painful, so should be avoided at all costs. With the development and implementation of this new technology, dentistry has another valuable aid that can certainly help to improve public opinion concerning dental treatments.

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