One of the objectives I have for Orthotown Magazine is to provide what I call “Current Status” articles, by recognized authorities, on the technology advances that are influencing today’s orthodontic treatment. For this article, I interviewed Dr. Stephen Tracey, an authority on the development of soft tissue lasers in orthodontics. I asked Dr. Tracey to explain the technical details of lasers and to review the status of today’s new lasers, not necessarily the application of lasers in orthodontic treatment. I hope you find his answers educational, to the point and helpful if you are considering implementing this technology into your practice or upgrading your existing laser.
Steve, give us a brief history of the use of lasers in dentistry and explain how you became one of the early pioneers to promote this technology in orthodontics.

Tracey: The term “laser” was first introduced to the public in 1959 in a paper titled, “The LASER, Light Amplification by Stimulated Emission of Radiation” by Columbia University graduate student Gordon Gould. The following year, the first working laser was demonstrated by American physicist Theodore Maiman at the Hughes Research Laboratories. Since that time, lasers have become nearly ubiquitous in our everyday lives. They are in our computer printers and DVD players; they record prices at the supermarket check-out; they guide weapons; and they measure distances between planets. Their introduction to the medical profession around 1975 revolutionized many surgical procedures by minimizing bleeding, swelling, scarring and pain. Then in 1989 the first laser specifically designed for use in dentistry was introduced. Sometime in 2002, I, along with friends and colleagues Drs. Jim Hilgers and David Sarver, began exploring the feasibility of incorporating the soft tissue laser into our practices as an adjunct to further elevate the aesthetic value of our final results. Ultimately each of us acquired lasers and subsequently published the very first articles in the orthodontic literature on the subject. I now own two soft tissue lasers, and as you know have become a strong proponent for their use in orthodontics.

Could you explain to us the various uses of lasers in dentistry, and more specifically, how you utilize the soft tissue laser in your orthodontic practice?

Tracey: Most practitioners are surprised to learn that over the years, lasers have been used in dentistry in a number of different ways. For example, Argon curing lasers have been around since the 1980s, diagnostic lasers such as the DIAGNOdent have been used since the late 1990s to assist in detecting caries, and 3D laser scanners have been used for many years to “translate” physical plaster models into virtual “e-models.” The two most popular types of lasers used in dentistry today are the Er:YAG and Er,Cr:YSGG (or hard tissue laser), and the diode (or soft tissue laser). Hard tissue lasers use a wavelength of light that is absorbed primarily by water and hydroxyapatite and are designed to cut precisely into bone and teeth, prepare teeth for bonding, remove small amounts of tooth structure, and repair certain worn-down dental fillings. Soft tissue lasers use a wavelength of light that is absorbed primarily by the pigment in the tissue and hemoglobin. This results in penetration and ablation of tissue along with simultaneous sealing of blood vessels and nerve endings. It is this type of laser that we as orthodontists are primarily interested in. Orthodontic indications for use of the diode laser include aesthetic gingival recontouring, exposure of both unerupted and partially erupted teeth, frenectomies, and disinfection and desensitization of aphthous and herpetic lesions.

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Are there any other uses of the diode laser you haven’t mentioned yet?

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Tracey: As a matter of fact there are several. On those unfortunate occasions when an arch wire or appliance gets embedded in tissue, the soft tissue laser is a lifesaver, allowing us to easily uncover and release the offending wire or appliance. One of my favorite uses of late is to use it instead of a tissue punch when placing miniscrews in unattached gingiva. A tissue punch invariably causes hemorrhaging, while the laser creates a perfect access opening with no bleeding.

When using the laser to remove tissue, is it necessary to anesthetize the patient with local anesthetic?

Tracey: If you mean give the patient an injection, the answer is invariably no. We use a very potent topical anesthetic called Profound PET (the PET stands for phenylephrine thick), which consists of 10 percent Lidocaine, 10 percent Prilocaine, four percent Tetracaine, and two percent Phenylephrine. This is formulated into a thick, green, mint-flavored gel by a compounding pharmacy.

Do the patients have much post-op pain?

Tracey: Amazingly, no. We advise patients to expect some minor discomfort, but nothing more than what a typical over-the-counter analgesic could handle. Most take no pain medication whatsoever. We also give them a manual toothbrush with extra-soft bristles to gently keep the area clean during healing. However, because the laser completely sterilizes the area, we never see swelling or infection so special rinses or antibiotics are unnecessary. Healing normally takes place quickly and uneventfully.

What settings do you use?

Tracey: First of all, most diode lasers, regardless of wavelength use similar power settings. For the majority of procedures involving removal of gingival tissue, I use a setting of 1.2 watts in Continuous Wave mode. For thicker, more fibrous tissue, such as is experienced when exposing unerupted cuspids on the palate, I use 1.4 to 1.6 watts of power in Continuous Wave mode. Frenectomies also require a higher power setting of about 1.6 watts, again in Continuous Wave mode.

What’s the difference between Pulsed mode and Continuous Wave mode?

Tracey: Hard tissue lasers always produce their laser energy in some form of a pulse that can be adjusted for both power and duration. Diode soft tissue lasers are different, not only in the wavelength of light that is produced but also in the way it is produced – a single continuous wave.
setting you normally use in Continuous Wave mode to get a similar result. Over the years I’ve had several doctors call me for help, frustrated that their laser didn’t seem to be working properly. In many instances the culprit was that they were using their laser in Pulsed mode with power settings recommended for operation in Continuous Wave mode. Bottom line, there is no real advantage to ablating tissue with a diode laser in Pulsed mode so don’t bother with it – always use the Continuous Wave mode.

Can you think of any other troubleshooting tips if a practitioner is having trouble ablating tissue with his or her laser?

Tracey: Yes. First check to see if both the power source and power button is switched on. Because of redundancy purposely built into lasers for safety reasons, it is possible with some lasers to switch the power on, but still not have the laser powered up and ready to go. Secondly, make sure the tip of the fiber has been initiated. All diode lasers, regardless of wavelength, need to have some type of pigment applied to the tip of the glass fiber that is going to be doing the work. This can be something as simple as painting the tip with a black Sharpie marker, or touching the tip of the fiber to articulating film while the laser is activated. This creates a super focus of energy at the tip as a result of the laser light being absorbed by the pigment. If you forget to initiate the tip in this fashion, you will not have enough energy retained at the tip of the fiber to effectively ablate tissue. Lastly, be sure the glass fiber that carries the laser energy from the unit to the working area is not broken. In some instances, a doctor or staff member may have accidently rolled a chair over the fiber, or inadvertently kinked it causing an unseen break somewhere along its length.

I’ve heard some doctors state that soft tissue lasers are nothing more than expensive electrosurgery units. How do you respond to that?

Tracey: Quite honestly, nothing could be further from the truth. Electrosurgery units use electrical current to burn tissue. They are less precise and cause 10 times more collateral tissue damage than a diode laser. Consequently, electrosurgical procedures result in greater postoperative pain and longer healing periods. Additionally, they provide less access to difficult areas adjacent to vital tooth structures, braces, amalgams, and implants and also require patients be grounded and anesthetized with a local anesthetic injection, prior to the procedure.

With a dizzying number of lasers to choose from, all claiming some form of superiority, how should an orthodontist go about deciding which laser to purchase?

Tracey: First, let’s take a look at the choice between a Er:YAG or Er,Cr:YSGG hard tissue laser and a diode soft tissue laser. For an orthodontist, this comparison shouldn’t even warrant discussion. However, as a result of some effective marketing, combined with suspect recommendations from a least one well-known lecturer, I feel it is important to set the record straight. I can see no reason on earth why an orthodontist would ever want to purchase a hard tissue laser, rather than a diode laser. To begin with, hard tissue lasers are primarily designed to do just that – cut hard tissues such as bone and enamel. Can you ablate soft tissue with a hard tissue laser? Sure. If you recall, the wavelengths of light used in the various hard tissue lasers are primarily absorbed by hydroxyapatite and water, which is great if your primary target is enamel, but not so great if your target is
soft tissue. However, most soft tissue contains a significant amount of water. Consequently, hard tissue lasers can ablate soft tissue by super heating the water within the tissue. However, due to the fact that these wavelengths are not absorbed nearly as well by hemoglobin and tissue pigmentation, hemostasis is greatly compromised when compared to that amount provided by a diode laser. The hard tissue laser is operated in what is called a “non-contact” mode that requires that the tip of the fiber be held 2-3 mm away from the target tissue. Conversely, the diode laser is operated in a “light contact mode” which affords the operator the much-appreciated proprioceptive feedback of light contact with the target tissue. The hard tissue laser operates in a wet field, while the diode laser operates in a dry field. The hard tissue laser is a large, bulky machine, while the diode laser can be as small and portable as an electric toothbrush. And lastly, a hard tissue laser can cost as much $80,000, or nearly 10 times the price of a diode laser. Diode lasers are specifically designed to ablate the soft tissue targets orthodontists are interested in, they are much better at producing hemostasis, they are infinitely more portable and much simpler to operate, and they are a fraction of the cost of a hard tissue laser.

It seems pretty obvious that choosing a diode laser is the way to go. But there are still a number to pick from, now with varying wavelengths. How do we go about deciding which diode laser to purchase?

Tracey: First, let’s debunk the myth that the wavelength used by one diode laser is superior to another wavelength used by a competitive diode laser. Originally, diode lasers used a wavelength in the neighborhood of 810 nm. In recent years, a number of diode lasers have been introduced that use wavelengths in the neighborhood of 980 nm and 940 nm, each claiming to be “kinder” to the tissue due to the fact that these wavelengths have a slightly higher affinity for water in the gingiva. On paper this might be true, but clinically I have found the differences to be insignificant. Bottom line – don’t fall for wavelength hype. They all work well so I wouldn’t let wavelength differences influence your purchasing decision to any great degree. However, four areas that should be considered carefully are features, portability, cost and support. With regards to features, the only thing you really need is a diode laser that will produce at least 2 watts of power in continuous wave mode. Additional power is either irrelevant or wasted. Beyond that, features such as touch screens, voice feedback, timers, pre-settings, advanced fiber systems, etc., are nice, but not indispensable. Needless to say, with most orthodontists operating multiple chairs simultaneously, the more portable the unit, the better. Saying that, once reasonable portability is achieved, anything smaller becomes more of a luxury. As far as cost goes, understand that the least expensive diode laser will ablate tissue just as well as the most expensive diode laser. Ultimately it will be up to you to decide if additional features are worth a greater investment. One area I do feel is important, even if it comes with a greater cost, is training and support. Look for companies that provide hands-on training, ideally with some form of recognized certification. And once the purchase is made, you should be confident the company will be around to back up their product, make repairs when necessary, and provide advice and accessories as needed. Diode lasers use solid-state semiconductors and are highly reliable machines. Saying that, an investment of $7,000 to $15,000 is not to be taken lightly, and you don’t want to be holding the bag should a rare problem occur.