• There are several dental lasers available in the marketplace today and all of them can perform soft tissue procedures. The erbium and the 9.3 micron Carbon Dioxide lasers are the only current machines that perform both soft AND hard tissue procedures.

• Lasers emit a distinct kind of light energy, sometimes called photonic energy. Light exists as both a particle and a wave; photon is the basic particle, and the energy is propagated as a wave, with both amplitude (the vertical portion of the wave above the zero line) and wavelength (the horizontal distance between two similar points on adjacent waves.)

• The lasers in general have one of two basic emission modes. One is continuous production, and the other is free-running (or naturally) produced pulsing. Diode lasers basically operate in continuous wave mode; Nd:YAG, erbium, and 9.3 micron Carbon Dioxide lasers can only function as free running pulsed. However, the continuous wave lasers can be gated or ‘pulsed’ with a variety of pulse durations, from tenths of a second to millionths of a second. There can be a difference in efficiency between continuous and pulsed (either free running or gated) emission.

• The word ‘Power’ is used to express the amount of work that the laser energy performs during a specific time period. The more useful term is ‘average power,’ which is the quantity of laser irradiation that is necessary to perform the procedure. All of the clinical procedures will be described with an average power parameter.

• Another term, ‘Peak Power,’ describes the maximum work that can be performed with each laser pulse. In other words, the clinician can adjust the peak power on the laser to maximize efficiency.

• The overlying principle of laser-tissue interaction is to use the maximum peak power necessary to efficiently perform the procedure, AND to use the minimum average power to safely perform the procedure.

• All surgical dental lasers have a photo-thermal interaction with tissue. In other words, the laser energy is absorbed, and heat is produced. The clinician must carefully observe the tissue and avoid excessive temperatures.

• The tissue temperature rise produced by the laser can cause various reactions.

• All lasers significantly reduce the amount of bacteria and other pathogens in the soft tissue surgical site, at a nominal tissue temperature of 50°C.

• Soft tissue interactions include coagulation and removal of granulation tissue by raising the tissue temperature to 60°C. These procedures are performed at temperatures and energies below those for ablation (removal of tissue.)

• For hard tissue, ablation of enamel, dentin and bone also produces an acoustic pop, as small particles of tissue are ‘exploded’ or ‘ablated’ away.

• Excessive heat will cause carbonization of any tissue, in which case there is permanent damage.

• With any surgical (tissue removal) laser procedure, the heat ultimately vaporizes the water in the tissue at 100°C (and in some cases the mineral component in hard tissue will be melted at
temperatures in excess of 800°C. The word ‘ablation’ is used, meaning the tissue is truly melted or evaporated. For example, a gingival papilla would be vaporized and thus removed; tooth preparation can involve vaporization of the water content of carious material and/or melting of the mineral component.

- In general, the use of a pulsed emission can offer more control over the rate of that tissue temperature rise. In other words, having the rapidly change from ‘on’ to ‘off’ repeatedly usually means a slower temperature rise in the tissue. However, to achieve your treatment objective, the target tissue will have to ultimately achieve an elevation in temperature.

- The energy from the diode and Nd:YAG lasers is absorbed primarily by soft tissue pigments and blood; the energy from the erbium laser is absorbed by water and to a lesser degree hydrated hydroxyapatite; the energy from Carbon Dioxide is absorbed first by mineral.

- There are different delivery systems on the various machines. The two most utilized are 1) a glass fiber optic bundle; and 2) an assembly of rigid tubes. Either of these are then coupled to a ‘handpiece’ which may or may not employ a tip to complete the system. All of the diode lasers available use a small flexible optic fiber to conduct the laser energy with a more rigid ‘tip’ that’s attached to the fiber. All of these are used ‘in contact’ with soft tissue for cutting, and ‘out of contact’ for coagulation and disinfection. Among the other laser wavelengths, there are two types of erbium laser delivery: one uses a large optical fiber and the other has an articulated arm. The Carbon Dioxide laser also has an articulated arm. There will be variations of tip employment: some ‘contact’ tips are used, or the beam is focused in a ‘non-contact’ manner.

Laser Safety

- A laser safety officer must be present to ensure proper protocol. Anyone with proper training can be appointed as a safety officer.

- Specific safety glasses are required for each laser. The wavelength protection data is marked on those glasses.

- Each laser has specific operating characteristics which include a key or code on switch, assembly of the delivery system, setting the surgical parameters, and standby and activation mechanisms.

- The practitioner must be familiar with the operation and set-up of the laser instrument as well as the obvious protocol for performing treatment with that device.

- The informed consent for patient treatment does not have to specifically include any device; rather the risks, benefits, and alternatives of treatment can discuss how you would use the laser.

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