Pulsed Wave Therapy Laser Review

Therapy lasers emit light in either:

1) a continuous wave
2) a pulsed wave
3) a super-pulsed burst

Some therapy lasers are capable of switching between these two modes of operation, while other therapy lasers solely operate in one mode or the other. While continuous wave therapy lasers are easy to understand (they emit a beam of light that is uninterrupted and constant), pulsed wave therapy ONLY devices require a bit more explaining. This is because pulsed wave therapy lasers cycle on and off in different ways and at different rates. Aspen therapy lasers offer BOTH continuous wave and pulsed wave outputs.

It is important to remember that devices that offer pulsed wave output ONLY are incapable of transferring more than a minimal amount of energy, usually much less than is required to effectively stimulate more that superficial healing. Many therapy laser manufacturers also claim their devices offer high-intensity output power -K-Laser™ is a good example, as they claim their devices offer 15Watts of output power, while only able to output at levels higher than 5Watts on pulse wave mode only, thereby transferring MUCH less energy than a continuous wave output laser. This represents deceptive advertising, as a clinician expects 15Watts of output power when purchasing such a device (which is sold for more than $25,000), and finds out after the fact that the device will quickly fail when outputting at more than 5Watts on continuous wave mode!

Pulse Parameters

All pulsed wave therapy lasers cycle on and off while operating – this cycle is called a “pulse”. However, the length of time that the laser is emitting light and turned off during each pulse varies between lasers. We can understand the length and frequency of a pulsed wave laser’s on and off cycles using the following parameters:

Pulse Duration (PD)

The amount of time, in seconds, that the laser is emitting light during each pulse.

Pulse Interval (PI)

The amount of time, in seconds, that the laser is off (not emitting light) during each pulse.

Pulse Frequency Rate (PFR)

The number of pulses (on and off cycles) that a pulsed wave laser goes through each second. This parameter is measured in hertz. Keep in mind that hertz are equivalent to cycles per second – so a laser with a PFR of 7Hz is emitting 7 pulses per second.

Duty Cycle (DC)

The Duty Cycle (DC) is the pulse duration (PD) multiplied by the Pulse Frequency Rate (PFR). A duty cycle is expressed as a percentage or a fraction and can be determined with the equation DC = PFR X PD

Duty Cycle Equation:
DC = PFR X PD
The duty cycle tells us the percentage of time that a pulsed wave laser is emitting light while operating. However, the duty cycle does not tell us the power output that a pulsed wave therapy laser is emitting while operating. *For example, a pulsed wave laser with a duty cycle of 50% (or ½) is emitting light only half of the time while in operation.*

Peak Power
The maximum power output, in watts, that a laser diode is capable of emitting

Average Power
The average power output, in watts, that a laser diode is capable of emitting over time.
It's important to identify the average power output of a pulsed wave therapy laser because laser therapy dosage is based on energy density.
This means that when a clinician keeps track of the Joules/cm2 being delivered to a patient, they account only for the average power output – not the peak power.

Average Power Equation:
Average Power = Peak Power x PFR x PD
Identifying the average power output of a pulsed wave therapy laser allows us to determine the energy density of a dosage delivered to a patient.

COMPARISON: Chopped Pulse Therapy Lasers versus Superpulsed Therapy Lasers
Pulsed wave therapy lasers are either:
1) chopped or
2) superpulsed

A chopped pulse wave therapy laser, also known as a "gated" pulse wave therapy laser, is essentially a continuous wave therapy laser that uses a pulse generator to turn on and off at programmable intervals. This is different than superpulsed lasers, which use semiconductor laser diodes. A semiconductor diode creates a high-wattage output for a very short amount of time *(typically 200 nano-seconds)* followed by an extremely long cool-down period. Very little energy is transferred using a superpulsed laser, and most of these kinds of devices are not really lasers, but are only *light therapy* devices.
A superpulsed laser diode will typically only emit light for about 1,000th of the time it is in operation, meaning its duty cycle is around 0.001%.

Deceptive Advertising: Class 3b "25-Watt Superpulsed" GaAs Diode Laser Produces "25mW"
Some brands of class III therapy lasers uses a superpulsed gallium arsenide (GaAs) laser diode with a peak power output of 25-watts. While that may sound impressive, keep in mind that this GaAs superpulsed laser diode is only capable of emitting 25-watts of power in brief, 200-nanosecond bursts, with a duty cycle of 0.001% - resulting in an average power output of less than 25mw (0.25-watts).

Understanding the difference between peak power output and average power output is key when reviewing pulsed wave therapy lasers. Many manufacturers like to boast about the high-wattage peak power outputs of their superpulsed laser diodes without being upfront about the average power outputs of their devices. Don't be fooled into thinking that a 25-watt superpulsed laser can deliver therapeutic results that are remotely similar to those you will see from a 25-watt continuous wave therapy laser. Boasting peak power outputs of superpulsed diodes is one of the many deceptive advertising practices that are being used in the laser therapy industry today.