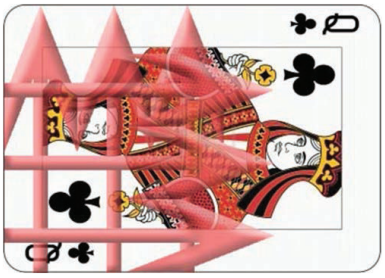
LASER THERAPY TREATMENT METHOD AND DURATION

The trend in laser therapy over the past several years has been to increase laser power density and dosage, since this has been shown to improve therapeutic outcomes considerably. The first therapeutic laser in the U.S. was cleared by the FDA in 2002 and had an output of 5mW of power. Several years later, The Pilot Laser has entered the marketplace and the power of FDA-cleared, therapeutic lasers can range up to 9,000mW or more, which represents an increase in power of 180,000 percent.



Treatment time is directly proportional to the output power of the laser you are using. The Pilot Laser is capable of emitting 9 watts of total output power, providing exceptional depth of penetration and speed of treatment. The goal of any treatment is to deliver the photons to the damaged or painful areas of the body. Treatment plans for a variety of disorders are included in separate documents.

In CW (Continuous Wave) mode at 9W (9 watts) power, the Pilot laser will output 540 Joules of energy into the target area in one minute. Spreading this energy over an area roughly the size of a standard playing card will deliver the needed levels of energy into the treatment area (9 J/ cm2). Mentally dividing the treatment area into playing card size segments is an appropriate guide to treatment duration. A patient with severe pain may require an area equivalent to six playing cards, therefore treatment would take approximately 6 minutes and deliver 3,240 Joules, assuming CW (Continuous Wave) mode at 9 watts (see Laser Energy Dosage Chart below).

When assessing area to be treated, it is important to factor in at least 'one playing card width' around the margin of the pain. A wider treatment area involves more cellular structure and enhances the overall beneficial effects.

In some cases, the treatment times may need to be increased. For example if the output setting is lower, say at 5W CW (continuous wave), which is more typical on small body parts like fingers and toes, then the length of time to treat the same area equal to a size of a playing card will be 2 minutes rather than the one minute at 9W. Power output can be incrementally increased to arrive at the highest output that is comfortably tolerated by the patient.

The patient should never feel thermal discomfort during or after treatment. If it becomes apparent that discomfort is experienced, lower the power setting and treat in a similar manner. Thermal relaxation time (the amount of time it takes the treatment area to heat up and cool down) is between 3 and 10 milliseconds. By appropriately moving the handpiece, heat will not build up in any particular area. Moving the handpiece further away from the treatment area will decrease the power density. When treating over darker or heavily pigmented skin you should pull the handpiece away from the skin and move your hand at a faster pace.

Remember that power or Watts equals the number of photons of radiation delivered over a specific time. The energy deposited (Joules) is the accumulation of these photons over time (1 Watt =1 Joule per second).

A higher power setting will be able to deliver therapeutic doses to deeper depths at equal treatment times; lower power settings will be able to deliver the same amount of energy, or Joules, as the higher power settings but only with longer treatment times.

Before performing any calculations of energy density, be sure that all quantities are expressed in their proper units; i.e., convert time in minutes to time in seconds. The power of a therapy laser is measured in watts, i.e. a milliwatt is one-thousandth of a watt: 1 mW = 0.001 W. Lasers used in therapy range in power from 5 mW up to 10 W. Convert the milliwatts to watts before doing any calculation (i.e., 5 mW = 0.005 W). You can think of the power of a laser just like the brightness of a light bulb: the higher the wattage, the brighter the laser light.

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LASER ENERGY DOSAGE CHART										
WATTS	JOULES									
12	720	1440	2160	2880	3600	4320	5040	5760	6480	7200
11	660	1320	1980	2640	3300	3960	4620	5280	5940	6600
10	600	1200	1800	2400	3000	3600	4200	4800	5400	6000
9	540	1080	1620	2160	2700	3240	3780	4320	4860	5400
8	480	960	1440	1920	2400	2880	3360	3840	4320	4800
7	420	840	1260	1680	2100	2520	2940	3360	3780	4200
6	360	720	1080	1440	1800	2160	2520	2880	3240	3600
5	300	600	900	1200	1500	1800	2100	2400	2700	3000
4	240	480	720	960	1200	1440	1680	1920	2160	2400
3	180	360	540	720	900	1080	1260	1440	1620	1800
2	120	240	360	480	600	720	840	960	1080	1200
1	60	120	180	240	300	360	420	480	540	600
0.5	30	60	90	120	150	180	210	240	270	300
TIME (in seconds)	60	120	180	240	300	360	420	480	540	600

Power is the time rate of delivery of energy, and the three are related by the following equation: **Power = Energy/Time**

You can calculate the energy delivered by a therapy laser by multiplying the power times the duration. For example, the energy delivered by a 100 mW laser in three minutes would be (converting the 100 mW to 0.1 W and the three minutes to 180 seconds): **Energy = Power x Time = 0.1W x 180 s = 18 J**

To calculate energy density, simply divide the energy in joules by the area in square centimeters as follows:
Energy Density = Energy/Area

For example, let us say the 18 J from the previous calculation is delivered to three different areas: 100 cm2 (the area of a standard playing card), 5.5 cm2 (the area of a postage stamp) and 0.4 cm2 (the area of a pencil eraser). As you can understand, 18 J of energy can produce widely varying amounts of energy density, depending on the size of the area being treated.

If energy density is too low, it will not bio-stimulate tissue; if it is too high it will inhibit healing or could even cause harm. Here is a good analogy: If you spread a gallon of water over an entire parched football field, you would have very few blades of green grass, and if you dumped that entire gallon onto a very small spot, you would have mud. The key to watering grass is getting the right amount of water per unit area, and the key to laser therapy is delivering the proper amount of laser energy per unit area.

What is the right amount of energy to deliver to a treatment area? Biostimulation has been reported to be effective with doses from as low as 0.001 J/ cm2 to 10 J/ cm2 and more; however, a great deal of difference exists between irradiating naked cells in a laboratory and treating a deep-lying pain condition.

Laser therapy dosage is a very complicated issue; it consists of wavelength, power density, tissue type and condition, the chronic or acute nature of the problem, skin pigmentation, treatment technique and so on. Certainly, a maximum effective therapeutic dose window does exist, but it is different for every patient because of the large number of variable factors used to determine the most effective dosage. An energy density of 4-8 J/ cm2 for superficial pain and 10-12 J/ cm2 for deep-lying pain is generally considered acceptable; 100 cm2 is considered a typical treatment area (about the size of a standard playing card). To calculate energy density, simply divide the energy in joules by the area in square centimeters. Remember the following simple equations: Power = Energy/Time; Energy = Power x Time; Energy Density = Energy/Area. Taking these factors into account will help you to determine the maximum effective treatment power setting and duration in order to most effectively treat your patients.

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