

LASER THERAPY DOSING

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Laser medical procedures utilize the number of total joules as a dose administered to a specific anatomical area which is usually described in the literature in terms of the target energy density, or energy applied per given area measured in square centimeters (energy density/fluence= joules/cm²) and applied at the skin surface. In general, for superficial conditions (those conditions in or just beneath the skin, where deeper light penetration into tissue is not required) a lower fluence is used as a target dose, and for deeper tissue conditions (those conditions beneath the skin, in the muscle, joints, or bones- where deeper penetration of light is required) a higher fluence is used.

General Fluence/Energy Density Guidelines for small animals in vivo:

Photobiomodulation elicits a biologic response between 4-20 J/cm²

Superficial Conditions/Penetration: 4-6 J/cm²

Deep Tissue Conditions/Penetration: 8-20 J/cm²

The fluence would also scale based on the size and body condition of the patient, as these will affect our "target tissue depth" as well.

The desired area to be treated may be measured in cm² and then the dose should be calculated:

$$\text{Desired Fluence (J/cm}^2\text{)} \times \text{area (cm}^2\text{)} = \text{total energy in joules to apply (J)}$$

Power (W) will determine the rate at which the energy is delivered as well as the irradiance/power density (W/cm²) of the laser beam depending on spot size:

$$\text{Power (W)} = \text{energy/time} = \text{joules (J) delivered/ second (s)}$$

Therefore, as an example, a 10 watt laser will deliver 10 joules/second, or over the period of a minute, would deliver 600 total joules. Power can be adjusted accordingly (In general, higher power is used for deeper tissue conditions and lower power is used for more superficial ones).

For example— laser therapy applied to the hip joint in large breed dog (35kg) in which the hip area is ~250 cm² (the joint itself as well as surrounding biomechanically associated soft tissues, etc.) would be calculated/recorded in the following manner: target fluence of 10J/cm² x 250 cm²= 2,500 J TOTAL dose over entire hip area.

- With class IV laser therapy at 12W power (CW), treatment time= 3 minutes, 28 seconds
- With class III laser therapy at 0.5W power (CW), treatment time= 83 minutes, 20 seconds

In addition to manually measuring a treatment area and figuring out the dosage based on the above calculations, there are other ways to calculate a therapeutic dosage:

- 1) Automatic protocols in laser software- be aware that these are programmed by the laser manufacturer. Your laser manufacturer should either list the parameters you are delivering with each automatic protocol selected on the laser device itself for transparency and medical records keeping, or should provide you with these parameters. In this way, you may always "check the math" based on the above recommendations to ensure the dosage seems appropriate.
- 2) Visual estimation "shortcut": the area of a standard CD/DVD disc is ~100cm², therefore to achieve a target deep tissue dose of 8-10 J/cm², one would need to deliver 800-1,000 total joules in this estimated size area of tissue

Superficial Conditions Include:

Wounds

Post operative incisions

Pyotraumatic dermatitis

Post-dental procedures where the gingiva is exposed

Otitis (external ear portion)

Deep Tissue Conditions Include:

Musculoskeletal conditions including soft tissue injuries, sprains, strains

Orthopedic conditions including osteoarthritis, fractures, etc.

Neurologic conditions including IVDD, GOLPP, DM, etc.