

# Proposed Guidelines for Reporting Parameters and Procedures of High- and Low-Level Laser Therapy in Medical Research Articles

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**Objective:** Laser therapy is increasingly used in clinical medicine, ranging from high-level laser therapy (HLLT) to low-level laser therapy (LLLT). This study proposes standardized guidelines for reporting parameters and procedures of HLLT and LLLT in medical research articles, aiming to improve clarity, reproducibility, and scientific rigor in clinical reporting.

**Methods:** The recommendations are based on insights from peer-reviewed studies that consistently identify gaps in the reporting of laser parameters and procedures. The key parameters include wavelength, power density, energy, energy density, and beam characteristics. Common issues noted are missing data, miscalculated doses, and unverified device specifications. To strengthen these recommendations, selected laser-tissue interactions were modeled using COMSOL Multiphysics. This modeling illustrates how power, spot size, and penetration depth affect treatment outcomes.

**Results:** The analysis revealed substantial inconsistencies in the way laser parameters are reported, often compromising reproducibility and reliability. The proposed framework introduces a structured checklist to support systematic documentation of treatment protocols, covering laser settings, irradiation, and treatment parameters.

**Conclusion:** Adopting these proposed guidelines can enhance the accuracy, transparency, and comparability of laser-based studies, filling a critical gap in current reporting practices and ultimately improving treatment validation and advancing the evidence base for HLLT and LLLT.

**Keywords:** high-level laser therapy (HLLT), low-level light therapy (LLLT), medical, guidelines, treatment outcome

## Introduction

Publishing in peer-reviewed journals is essential for advancing medical knowledge and ensuring reproducible clinical outcomes.<sup>1-4</sup>

Laser therapy has become an indispensable tool in modern medicine, with applications ranging from high-power surgical interventions to low-power photobiomodulation treatments.<sup>5</sup> The precision and effectiveness of these procedures depend heavily on accurate reporting of technical parameters, underscoring the importance of clear and consistent documentation in the scientific literature.<sup>6</sup>

Despite the growing number of high-quality publications on laser applications, significant shortcomings remain in the reporting of fundamental parameters. Multiple reviews of High-Level Laser Therapy (HLLT) and Low-Level Laser Therapy (LLLT) have demonstrated frequent omissions of essential data such as beam characteristics, dosimetry, and treatment intervals, which compromise reproducibility and clinical translation. For example, Fulop et al<sup>7</sup> reported that 19 of 22 reviewed studies failed to provide basic details such as wavelength, power, or power density. Such gaps persist across diverse fields, including dermatology, pain management, wound healing, and physiotherapy, despite the wide adoption of both HLLT and LLLT in clinical practice, including in surgical settings.<sup>8</sup> Importantly, although both modalities apply light energy to tissues, they differ fundamentally in power levels, therapeutic goals, and biological effects.<sup>9</sup>

Because direct measurement of light propagation in tissues is rarely feasible, reliable dosimetry must instead rely on a complete description of irradiation parameters (eg, wavelength, power, beam area, and pulse structure) and dose parameters (eg, energy, energy density, exposure time, and treated area).<sup>10–13</sup> The absence of such details not only limits the comparability of results but also impedes the establishment of standardized treatment protocols.

This study proposes descriptive guidelines and a structured checklist for reporting parameters and procedures in HLLT and LLLT, addressing existing gaps in clarity and reproducibility. In addition to evidence from previous studies, COMSOL Multiphysics (v6.2) simulations were used to illustrate light–tissue interactions under varying clinical conditions. Optical properties derived from the literature ( $\mu_a \approx 0.2 - 0.5\text{cm}^{-1}$ ,  $\mu_s \approx 80 - 120\text{cm}^{-1}$ ,  $g \approx 0.8-0.9$ ,  $n \approx 1.37-1.40$ )<sup>14,15</sup> were applied to approximate soft tissue behavior. While not intended as validated models, these simulations provide supportive evidence that parameter specification directly influences reproducibility, underscoring the need for consistent and transparent reporting to guide clinicians and researchers across medical disciplines.

## Defining High-Level and Low-Level Laser Therapy

High-Level Laser Therapy (HLLT) is a treatment method that uses a high-power laser to deliver targeted energy to specific affected areas. Often referred to as therapeutic or ablative laser therapy, it is typically employed in clinical procedures requiring higher energy levels for tissue modification, such as surgery or tumor removal. HLLT uses lasers with higher power densities, usually in the range of 1 to 10 watts, and can involve both thermal and non-thermal effects depending on the clinical requirements. These lasers are frequently used in dermatology, oncology, dentistry, and oral surgery for cutting, coagulating, or vaporizing tissues.<sup>16–18</sup>

Low-Level Laser Therapy (LLLT), in contrast, involves the use of red or near-infrared (NIR) light (600–1100 nm), with a lower-power laser, usually in the range of 1 mW to 1000 mW.<sup>19,20</sup> LLLT has no thermal effects and is primarily used for its bio-stimulatory effects on tissue healing, pain reduction, and inflammation modulation. It is widely used in physiotherapy, dermatology, wound healing, skin rejuvenation,<sup>21</sup> and pain management. The primary therapeutic mechanism involves photo-biomodulation (PBM), where light energy is absorbed by cells, triggering biochemical processes that accelerate tissue repair and decrease inflammation. Despite its positive effects, it remains controversial among researchers and clinicians due to a lack of knowledge and information in clinical research.<sup>22,23</sup>

## Key Laser Parameters for Treatments

Many researchers and practitioners believe that simply focusing on wavelength and energy (measured in Joules or energy density in  $\text{J}/\text{cm}^2$ ) is sufficient for replicating successful treatments. However, this perspective often overlooks other critical factors, such as the original power  $W$ , power density or irradiance  $W/\text{cm}^2$ , timing parameters, and whether the laser is continuous or pulsed. This is a common yet significant mistake when writing a medical article about laser therapy.<sup>24</sup>

Authors should follow a systematic approach to ensure clarity and scientific accuracy in their work. Below are the key sections to include:

When using a laser, there are at least nine important parameters that should be considered and discussed in every article: wavelength, operation mode, power, and power density, energy and energy density, spot size, pulse parameters, irradiation time, number of treatments, and cooling. If a laser device allows for independent control of each of these parameters, you can adjust the treatment more precisely to meet your patient's needs.

## Wavelength

Wavelength is crucial in HLLT and LLLT, influencing tissue penetration depth and biological effects on target cells. Medical literature must provide details on optimal wavelengths for specific treatments to help practitioners choose the right laser. Generally, shorter wavelengths (200–600 nm) penetrate superficially, while longer wavelengths (650–1200 nm) penetrate deeper. The least penetrating wavelengths are found in the far UV and far IR due to their high-water affinity. Clear guidelines on these parameters are essential for effective and safe laser therapy across medical processes.<sup>12,25</sup>

## Operating Mode

In Low-Level Laser Therapy (LLLT) and High-Level Laser Therapy (HLLT), it's important to specify whether the laser operates in continuous (CW) or pulsed mode. Continuous lasers produce a consistent beam of light, delivering a steady and uniform dose to the target tissues. In contrast, pulsed lasers emit light in short bursts, allowing for higher peak powers and potentially deeper tissue penetration while reducing thermal buildup. The choice between continuous and pulsed modes depends on the specific therapeutic goals and the nature of the condition being treated.<sup>12</sup>

## Power and Power Density

Peak Power refers to the maximum energy output of a laser in short pulses, measured in watts (W) or milliwatts (mW). It is crucial in HLLT for tasks like tissue cutting or coagulation. It can be calculated with the formula  $P_{Peak} = \frac{E_{Pulse}}{PulseDuration}$ , where  $E_{Pulse}$  is the energy per pulse and pulse duration is the pulse length. Average Power is more relevant in LLLT, where thermal effects must be avoided, measured in watts (W) or milliwatts (mW) and calculated by the formula:  $P_{Avg} = \frac{E_{total}}{totaltime}$ . Power density (irradiance, W/cm<sup>2</sup>) is the average power distributed per unit area and strongly influences tissue penetration. Higher power densities can cause overheating, while lower densities are safer for healing.<sup>26</sup> It is calculated as:  $PD = \frac{P_{Avg}}{spotarea}$ .

As illustrated in [Figure 1](#), increasing power density from 20 to 40 W/cm<sup>2</sup> leads to deeper photon deposition and higher subsurface temperatures, emphasizing the importance of considering thermal effects beyond surface dose.

## Energy Density and Spot Size

Energy density (fluence, J/cm<sup>2</sup>) and power density (irradiance, W/cm<sup>2</sup>) are related but distinct concepts. Energy density reflects the total energy delivered per unit area, while power density indicates the instantaneous power per unit area. Both depend on spot size, which defines the beam's cross-sectional area at the tissue surface. Spot size is therefore a critical parameter: larger spots, at the same total energy, reduce fluence and irradiance, resulting in more superficial energy deposition, whereas smaller spots concentrate the beam, increasing localized heating and photon penetration.<sup>12,27–29</sup>

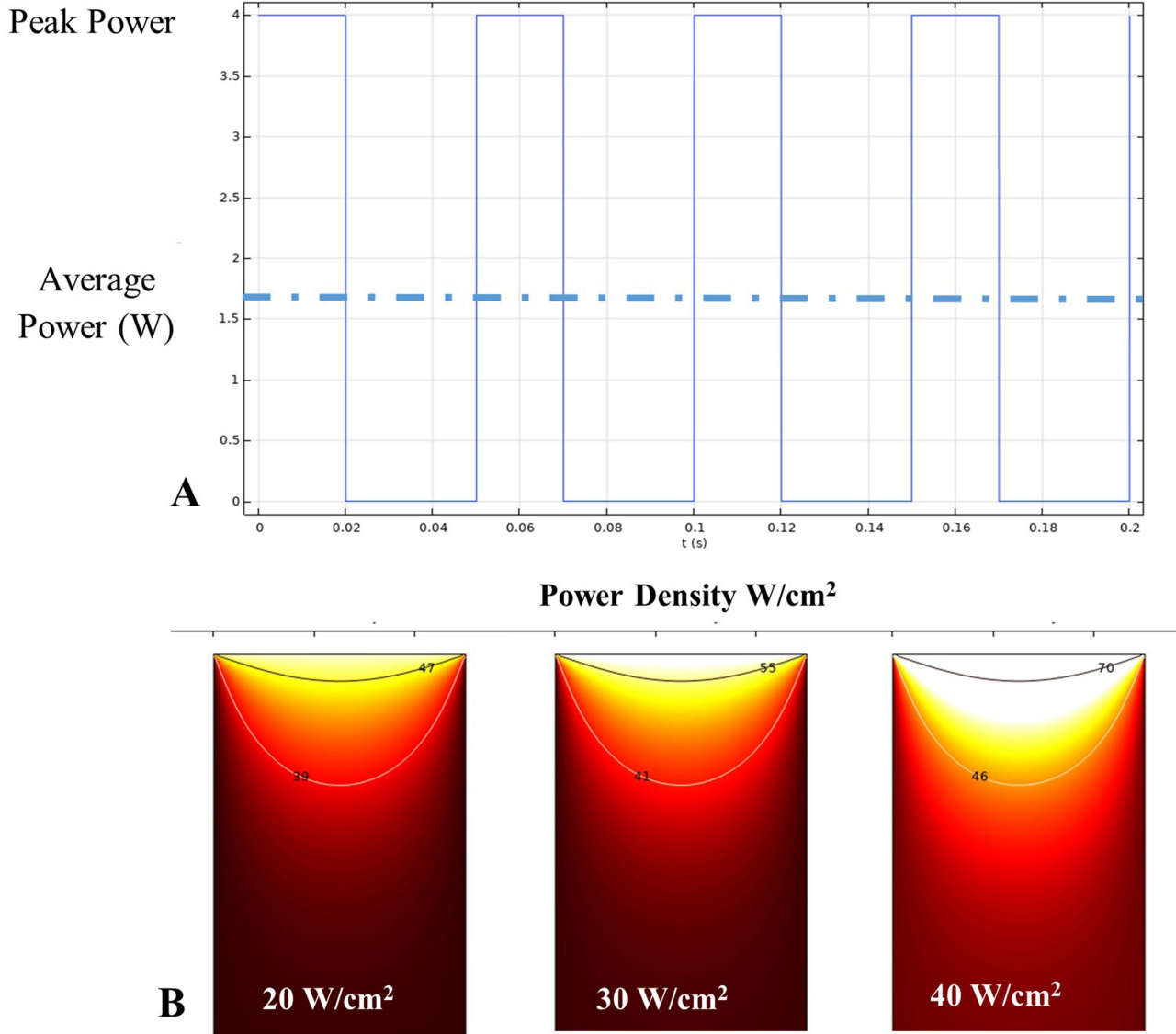
[Figure 2](#) illustrates this inverse relationship, showing how smaller spots (eg, 2 mm) produce denser surface energy and higher thermal gradients, while larger spots (eg, 8 mm) disperse energy more broadly with shallower effects. Although smaller spots enhance surface intensity, increased scattering can reduce penetration depth, creating a more superficial therapeutic effect.<sup>26</sup>

Clinically, spot size directly affects required fluence. For example, closing a vessel may require 80 J/cm<sup>2</sup> with an 8 mm spot, 160 J/cm<sup>2</sup> with a 4 mm spot, and 240 J/cm<sup>2</sup> with a 2 mm spot, demonstrating that halving the spot size generally necessitates doubling the energy to achieve similar treatment depth.<sup>12</sup> Larger spots also enhance thermal load, potentially increasing pain.

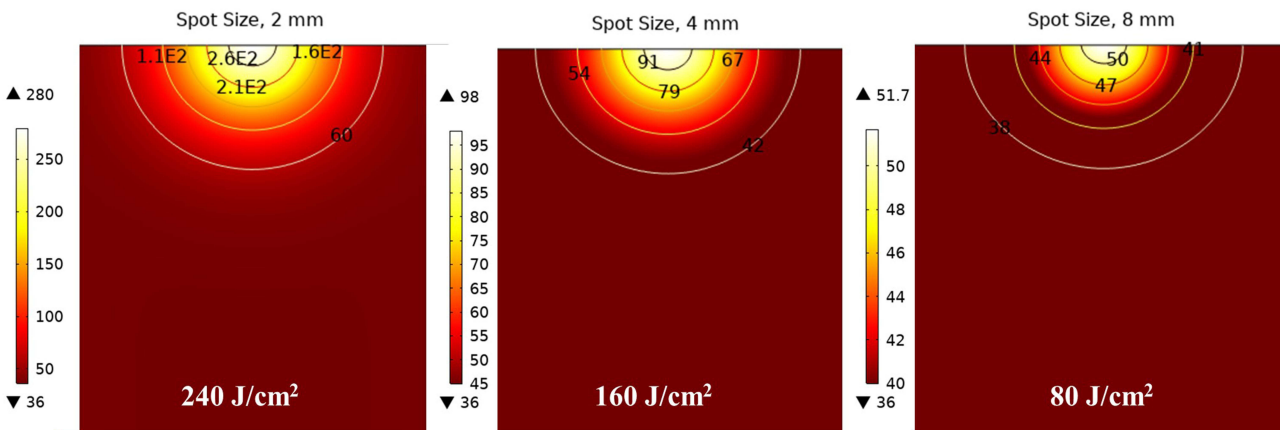
Ultimately, wavelength remains the dominant factor influencing penetration. Between 355–1200 nm, scattering in skin layers increases approximately linearly, whereas above 1200 nm, absorption by water predominates, reducing penetration.<sup>28,30,31</sup>

## Pulse Width

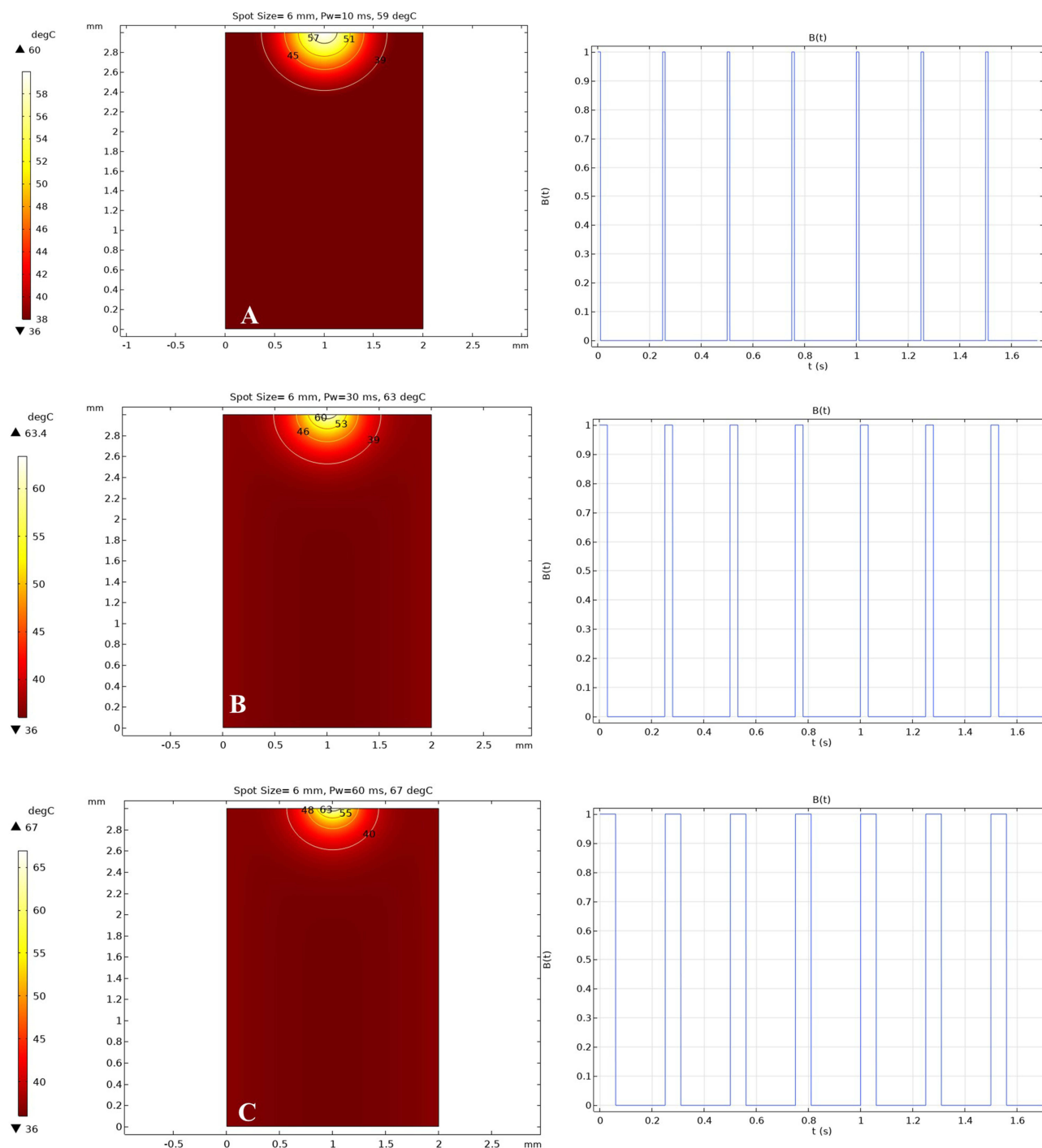
Refers to the duration of energy delivery to the target tissue. Its selection is closely related to the thermal relaxation time (TRT), which represents the time required for heat to dissipate from the irradiated tissue.<sup>32</sup> To confine thermal effects within the target and avoid damage to adjacent structures, the pulse width should generally be shorter than the TRT, a principle known as selective photothermolysis.<sup>25,33</sup> Larger tissue volumes require proportionally longer pulse widths to achieve sufficient heating, whereas smaller targets respond adequately to shorter exposures. For optimal results, the pulse width is often recommended to approximate half of the TRT.<sup>34</sup> [Figure 3](#) demonstrates that, at the same spot size and energy density, a longer pulse width (Pw) leads to a higher tissue temperature. It should be noted that TRT is primarily determined by tissue optical and thermal properties as well as target dimensions, rather than patient age itself. Nevertheless, biological factors such as hydration, vascularization, and structural changes that occur with aging or pathology may indirectly alter tissue heat diffusion and, consequently, influence TRT in clinical settings.



**Figure 1** (A) Relationship between peak power and average power. (B) Contour lines illustrate that higher irradiance values (20–40  $W/cm^2$ ) increase photon penetration depth and subsurface heating.



**Figure 2** Effect of spot size on energy density and dose distribution. Smaller spots (eg, 2 mm) increase surface fluence and localized heating, while larger spots (eg, 8 mm) distribute energy more broadly with shallower penetration.



**Figure 3** Thermal rise at spot size 6 mm and constant fluence with increasing pulse width. **(A)** Pw =10 ms, peak ~59°C, **(B)** Pw 30 ms, peak ~63°C, and **(C)** Pw = 60 ms, peak ~67°C. Longer pulses (10–60 ms) raise peak temperatures, underscoring thermal relaxation time's role in safe treatment planning.

## The Sufficient Dose (Energy Density or Fluence)

Dosage is equivalent to energy density. When examined from another perspective, it is Power Density multiplied by time expressed in seconds. Key factors in this equation are Average Power, the diameter of the handpiece aperture (spot size), and time. Common laser spot sizes can vary depending on the application and type of laser. Generally, range from a few micrometers ( $\mu\text{m}$ ) to several millimeters (mm).

For example, if the diameters of the spot sizes are 0.4 mm, 3 mm, 6 mm, 10 mm, and 15 mm, we can use the dose formula:  $Dose = Power * time / \pi r^2$ , where dose ( $J/cm^2$ ), power (W), time (S), and area ( $cm^2$ ).<sup>10,35,36</sup> In this equation, the radius “r” is equal to half of the diameter. Using this formula, we can create Table 1 to display the dose change for each laser firing over one minute (60 seconds) based on these spot sizes.

Laser energy decreases exponentially as it propagates through biological tissue due to absorption and scattering. A commonly used approximation often used in clinical settings is a 50% reduction in fluence per centimeter of depth, although the exact rate varies with tissue type and wavelength.<sup>10,14,15</sup> As illustrated in Table 2, achieving a therapeutic dose at depth requires progressively higher surface doses. For example, delivering 10  $J/cm^2$  at 2 cm depth requires 40  $J/cm^2$  at the surface. This simple exponential model emphasizes why accurate reporting of surface parameters is essential for ensuring that an effective dose reaches the target tissue.

It is important to carefully consider the average reported power, especially when employing more than one diode laser, as is usual in LLLT. Ensure that the actual dose to be delivered is accurately verified.

For example, consider a 100 mW diode laser operating at maximum power, where the peak power equals the average power. In this case, the average power is 100 mW. If five 100 mW diodes are placed in the same handpiece and spread out to cover a larger area, the average power remains 100 mW, not 500 mW. This is because the peak power can be summed up as 100 mW times 5 diodes, resulting in 500 mW of peak power. However, for the area where each diode interacts with the body, there is still only 100 mW of average power. Therefore, the dose received would be the same for both configurations of lasers.<sup>21,36</sup>

Another example is when a laser device uses multiple diodes that can fire independently but simultaneously through the same aperture, the average power output of each diode can be summed to calculate the total average power delivered. This is because each diode contributes its power to the overall energy output, enhancing the total dose delivered to the

**Table 1** Calculated Dose Values ( $J/cm^2$ ) at Different Spot Sizes and Average Powers Over 60s Irradiation. Smaller Spot Sizes Produce Higher Energy Density at the Same Power

Average Power (W)	Laser Spot Size (mm)				
	0.4	3	6	10	15
50 mW (0.05 W)	2387 $J/cm^2$	42 $J/cm^2$	11 $J/cm^2$	4 $J/cm^2$	1.7 $J/cm^2$
100 mW (0.1 W)	4774 $J/cm^2$	84 $J/cm^2$	20 $J/cm^2$	8 $J/cm^2$	3.4 $J/cm^2$
500 mW (0.5 W)	23873 $J/cm^2$	224 $J/cm^2$	110 $J/cm^2$	40 $J/cm^2$	17 $J/cm^2$
1000 mW (1 W)	47746 $J/cm^2$	849 $J/cm^2$	210 $J/cm^2$	80 $J/cm^2$	34 $J/cm^2$
5000 mW (5 W)	238732 $J/cm^2$	4244 $J/cm^2$	1060 $J/cm^2$	380 $J/cm^2$	170 $J/cm^2$

**Notes:** Example: At 100 mW and a 3 mm spot size, the delivered dose is ~84  $J/cm^2$ , which is consistent with clinically reported effective doses in photobiomodulation protocols.

**Table 2** Example of Exponential Attenuation of Laser Fluence in Tissue (Assuming ~50% Loss per Cm)

Depth (cm)	Relative Energy (%)	Required Surface Dose for 10 $J/cm^2$ at depth cm
0 (at the skin)	100	40
1	50	20
2	25	10
3	12.5	5
4	6.25	2.5

target area. For instance, if a laser device has five diodes, each with an average power of 100 mW, and all of them fire at the same time through a single aperture, the total average power would be 500 mW. This is because the power contributions from each diode add together, resulting in greater energy available for treatment.

This concept is important in ensuring that the total dose delivered meets the required therapeutic levels, especially when covering larger areas or requiring higher energy inputs.<sup>10,33</sup>

## Arndt-Schulz Law and Laser

The Arndt-Schulz Law states that weak stimuli enhance physiological activity, moderate stimuli may inhibit it, and strong stimuli can eliminate it. This principle is commonly applied in various therapies, such as LLLT and HLLT.<sup>37,38</sup> At low doses, LLLT promotes cellular activity and beneficial biological responses, while moderate doses may inhibit these processes, and excessive doses can cause tissue damage. Experimental findings support this biphasic effect: Lopes et al<sup>39</sup> reported that two 660-nm lasers delivering the same total energy produced opposite outcomes in a hamster oral mucositis model, with lower power reducing inflammation and higher power exacerbating it. Similarly, Oron et al<sup>40</sup> demonstrated that only an intermediate intensity (5 mW/cm<sup>2</sup>) of an 810 nm laser reduced scar tissue in infarcted rat hearts, whereas lower and higher intensities were ineffective. These observations underscore the importance of precise reporting of all laser parameters. The biphasic response is consistent with mitochondrial mechanisms of photobiomodulation, where low power densities enhance cytochrome c oxidase activity, ATP production, and repair pathways, while higher intensities may generate excessive reactive oxygen species and thermal stress, leading to inhibition or inflammation.<sup>14,35</sup>

## Irradiation Time

The irradiation time is a major factor in laser treatments that significantly affects therapeutic outcomes. The duration of tissue exposure to laser energy directly impacts how the tissue interacts with the treatment, including absorption, thermal effects, and biological responses. Specifying the irradiation time in treatment protocols is essential for reproducibility and comparison across different studies. Insufficient exposure may result in suboptimal outcomes, while excessive exposure can cause tissue damage or unwanted side effects. The length of laser exposure impacts the thermal buildup in HLLT. Longer irradiation times can enhance therapeutic effects like coagulation and tissue remodeling, but risk overheating and thermal damage. Increased irradiation time also improves laser energy penetration, essential for treating conditions at different tissue depths, especially in dermatology, targeting various skin layers.

The biological response to laser treatment, such as cell proliferation, collagen production, and modulation of inflammation, which is observed in LLLT is influenced by the duration of exposure. As a result, choosing the appropriate irradiation time is critical for optimizing these responses and improving the overall effectiveness of the treatment.<sup>41-43</sup>

## Number of Treatments, and the Interval Between Treatments

The number and frequency of treatments in HLLT and LLLT are critical to achieving effective results. The total number of sessions required depends on the specific procedure and the patient's response. LLLT typically involves 10 to 20 sessions scheduled 2 to 3 times per week over 6 to 8 weeks, with 3 to 7 days between sessions to allow for tissue recovery. It should also be noted whether the treatment is performed in one pass or multiple passes. Adjusting the number and timing of treatments based on the patient's response helps improve efficacy and reduce side effects.<sup>36</sup>

## Cooling

Cooling is mainly relevant in HLLT, where higher power densities can induce unwanted thermal effects. Techniques such as contact cooling or cryogen spray help protect the epidermis, reduce pain, and enable deeper penetration by maintaining safe surface temperatures.<sup>44,45</sup> In contrast, cooling is not required in LLLT, as the therapy is designed to act through non-thermal photobiomodulation mechanisms.

## Standardized Reporting of Laser Parameters

Standardizing parameter reporting ensures consistent and clear data presentation. Acknowledging the critical need for precise and thorough reporting of technical and therapeutic parameters, we recommend adopting a standardized tabular format [Table 3](#) for presenting this information.

Discrepancies between the manufacturer's specified performance parameters of laser devices and their actual performance are common.<sup>46</sup> To ensure the reported parameters' accuracy and value, it is crucial to ascertain whether they are: 1) derived from the manufacturer's specifications, including stated tolerances (eg,  $630 \pm 5$  nm, meaning the actual wavelength may vary within this range); 2) the parameters were measured by the manufacturer or the researcher, accompanied by information on the instrumentation used, its calibration, and the measurement procedure; or 3) the values were independently tested and validated, with reference to the responsible testing body and the corresponding results.<sup>24</sup>

Beam power can diminish with increasing device temperature and age, necessitating routine checks during experiments. Accurate measurements of beam area and power require specialized instruments and trained technicians. Therefore, power measurements should be conducted both before and after research experiments and at frequent intervals to ensure precision and reliability.

The criteria and dose chosen, along with medical and patient factors such as pathology, etiology, lesion type (acute vs chronic), anatomical location, target tissue depth, skin pigmentation, and general condition of the patient, are all important and should be reported. For a standardized method of data collection and presentation to be effective, it should become a standard procedure. Therefore, we recommend that peer-reviewed journals provide authors with a structured format, suggested tables, and instructions to be completed and submitted before manuscript review.<sup>24,42</sup>

## Application Examples

To illustrate the importance of standardized reporting, consider a clinical application of the Klas-S81 infrared diode laser for the management of musculoskeletal pain.

A single-emitter infrared diode laser (Klas-S81, Konf, 2022) was applied in continuous wave (CW) mode at a central wavelength of 808 nm. The device (Model S81) delivered an average radiant power of 110 mW at one emitter, with a circular Gaussian beam profile and symmetrical beam shape. The spot size at the target was 3 cm<sup>2</sup>, resulting in a power density of 0.037 W/cm<sup>2</sup>. Each exposure lasted 60seconds per point, yielding a radiant energy of 6.6 J and a fluence of 2.2 J/cm<sup>2</sup>. The total irradiated area per session was 3 cm<sup>2</sup>. The protocol consisted of one point per session, three sessions per

**Table 3** Proposed Standardized Format and Key Parameters for Reporting in HLLT and LLLT Studies

Device Information	Irradiation Parameters	Treatment Parameters
1. <input type="checkbox"/> Manufacturer, Model, Year* 2. <input type="checkbox"/> Number/ type of Emitters*(a) 3. <input type="checkbox"/> Emitter Spatial Distribution*(b) 4. <input type="checkbox"/> Beam Transmission System*(c)	1. <input type="checkbox"/> Center wavelength [nm]*(d) 2. <input type="checkbox"/> Wavelength Range [nm]* 3. <input type="checkbox"/> Operating mode (CW/pulsed)* 4. <input type="checkbox"/> Frequency [Hz]* 5. <input type="checkbox"/> Pulse on-time [s] and off-time [s] *(e) 6. <input type="checkbox"/> Pulse width [s], duty cycle [%]*(f) 7. <input type="checkbox"/> Energy per pulse [J]* 8. <input type="checkbox"/> Peak power [mWor W], Average power [mWor W]* 9. <input type="checkbox"/> Polarization 10. <input type="checkbox"/> Aperture diameter [cm] 11. <input type="checkbox"/> Power density at aperture [mW/cm <sup>2</sup> ](g) 12. <input type="checkbox"/> Beam divergence [rad or deg]/ shape/profile*(h,i)	1. <input type="checkbox"/> Spot size at target [cm <sup>2</sup> ]*(k) 2. <input type="checkbox"/> Power [w] 3. <input type="checkbox"/> Power density at target [mW/cm <sup>2</sup> ]*(l) 4. <input type="checkbox"/> Exposure duration [s]*(m) 5. <input type="checkbox"/> Energy density (Fluence) [J/cm <sup>2</sup> ]* 6. <input type="checkbox"/> Radiant energy [J]* 7. <input type="checkbox"/> Number of points irradiated* 8. <input type="checkbox"/> Area irradiated [cm <sup>2</sup> ]*(n) 9. <input type="checkbox"/> Number and frequency of treatment sessions* 10. <input type="checkbox"/> Total radiant energy [J]*(o) 11. <input type="checkbox"/> Application technique*(p) 12. <input type="checkbox"/> Protocol*(q)

**Notes:**(a) Emitter type: eg, LEDs, laser diodes. (b) Spatial distribution: arrangement and spacing of emitters. (c) Beam transmission system: the method by which the laser/light is delivered from the device (eg, direct handpiece, lens system, fiberoptic cable). (d) Wavelength: central emission and operational range. (e) Pulse on/off duration: active emission time ("on-time") and silent interval ("off-time"), together defining the duty cycle. (f) Pulse width: duration of a single pulse. (g) Power density at aperture: irradiance measured at the device's exit point (aperture), before beam divergence or tissue interaction. (h, i, j) Beam properties: divergence, shape (circular/rectangular), and profile (eg, Gaussian, top-hat). (k) Spot size: beam cross-sectional area at the tissue surface. (l) Power density at target: irradiance measured at the tissue surface, determined by the actual spot size at the target. This is the clinically relevant value for dose calculation. (m) Exposure duration: time of laser application at the target site. (n) Area irradiated: total surface area receiving treatment. (o) Total radiant energy: cumulative energy delivered over all sessions. (p) Application technique: the way the beam is applied to the patient (eg, direct skin contact, contact with pressure, non-contact, interstitial fiber delivery). (q) Protocol: structured treatment plan including dose, intervals, and session details. Essential items are indicated with an asterisk (\*); however, it is recommended that all available parameters be included.

week over four weeks (12 sessions in total), delivering a cumulative radiant energy of 79.2 J. No cooling was applied during treatment.

For illustration of HLLT, a high-powered 675-nm laser (Quanta System, Model Q-plus, 2023) was employed for dermatological ablation. The device operated in pulsed mode at a frequency of 20 Hz with a duty cycle of 25%. The peak radiant power was 5 W, with an average power of 2 W, delivered through a circular spot of 0.2 cm<sup>2</sup>. This configuration provided a power density of 10 W/cm<sup>2</sup> at the target. The beam had a top-hat profile with a circular shape to ensure uniform energy distribution. Each pulse delivered 0.1 J with a pulse width of 50 ms, corresponding to a fluence of 5 J/cm<sup>2</sup> per pulse. The total irradiated area per treatment site was approximately 0.2 cm<sup>2</sup>. Treatment was applied in multiple passes with integrated contact cooling (sapphire plate maintained at 4°C). A single session delivered a cumulative radiant energy of ~150 J per lesion.

These examples underscore the importance of consistently reporting irradiation and dose related parameters to ensure reproducibility and enable meaningful comparisons across studies. The proposed framework is consistent with international recommendations, including those of the World Association for Laser Therapy (WALT),<sup>36</sup> and aligns with previously reported optical and computational findings.<sup>14,15</sup>

As a guideline article, the present work does not aim to provide experimental validation but rather to establish a structured and standardized approach for reporting laser parameters in medical research. Its primary contribution is to support researchers and clinicians in improving the accuracy, credibility, and transparency of laser-related publications, thereby facilitating clinical translation and advancing the evidence base.

## Conclusion

Standardization in reporting laser parameters and procedures is essential to enhance reproducibility, comparability, and clinical confidence in both HLLT and LLLT research. The proposed framework, supported by literature evidence and simulation modeling, provides clear and descriptive recommendations that can be universally applied by clinicians and researchers in phototherapy. By adopting these directives, future studies will be better equipped to ensure methodological rigor, facilitate independent validation, and promote the safe and effective use of laser therapy across various medical disciplines. These guides must contain at least four types of parameters: (1) device manufacturer, (2) irradiation parameters, (3) treatment dosages and intervals, and (4) protocol.

## Data Sharing Statement

All data are included in the article.

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## Disclosure

The author declares no conflicts of interest.

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