GUEST EDITORIAL 7.4
CORRECT REPORTING OF DATA: "WATTS A JOULE(1)" REVISITED

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With this final issue of Volume 7 I am at the end of seven years as a member of the Editorial team of Laser Therapy. In addition to thanking the Editors-in-Chief and the publishers for the opportunity to write this Editorial, I would like to take this opportunity to thank all those who have contributed to the journal, and to those who will do so in the future, I tender my thanks in advance. I would also like to thank all members of the Editorial Board for their assistance and advice, so freely given when required, and to the editorial and production teams for their unflagging hard work. I must also apologise (again) for the delay in the publication of the last two issues of Volume 7. With this, however, I am certain the delays will be at an end, and you can look forward to timely delivery of the journal from Volume 8 onwards.

In this issue, I should like to talk (again) about terminology. The terms 'low power laser' and 'low energy laser' still appear with surprising frequency in the literature. I would ask the readers to consider the basic physics, and having done so I am sure it will be clear that LLLT systems are not always necessarily low powered, nor do they always deliver low energy, and that the terms are not always interchangeable. Consider two separate sets of laser parameters from laser systems: first the Q-switched ruby laser, definitely a member of the high reactive-level laser treatment (HLLT) family of photodestructive lasers. The system can produce extremely high peak powers. This laser typically has a peak power per pulse in the order of 10^9 watts and an ultrashort pulse of 10^-9 seconds, so by applying the formula W·s = J we find that the energy delivered is:

10^6 W x 10^-9 s = 10^-3 J

In other words, despite the very high output power, the actual energy delivered is 10^-3 J due to the ultrashort irradiation time. In this case, high output power is delivered with an extremely low energy. Now consider a GaAlAs diode LLLT system delivering an output power of 10^-2 W, over an extended exposure time of 10^4 seconds.

10^-2 W x 10^4 s = 10^2 J

In this instance, the output power is extremely low, but the delivered energy is very high. From the above, it can be seen that 'low power' lasers are not necessarily 'low energy', neither do high power lasers always deliver high energy. In common with the former Editor-in-Chief and my good friend and colleague, Dr. Toshio Oshiro, I feel very strongly that all researchers and clinicians should try to adopt correct and agreed terminology: in doing so, you will not only be assisting other workers in the field to duplicate experimental finding and clinical results, but you be also helping the credibility of laser therapy as the up-and-coming specialty it is.

While thinking of terminology, I would like to look once again at the term 'Low reactive-Level Laser Therapy' (LLLT). LLLT is defined as describing a tissue effect where there is no photodestructive change or reactions in the laser-irradiated tissue; at the other end of the power scale, High reactive-Level Laser Treatment (HLLT) produces irreversible photodestructive changes, either thermal or nonthermal in nature. Some authors have appeared to limit damage to photothermally-caused reactions: there are other nonthermal mechanisms which can cause damage; for example the selective cell destruction in dihaematoporphyrin ether infiltrated tumours during photodynamic therapy (PDT), following irradiation with low output powers of red laser light. There is no thermal destruction in this reaction, but there is irreversible cell death. Accordingly, this is classified as an HLLT reaction, even though the output power of the laser is in milliwatts. There are other nonthermal effects – photo-osmosis and photo-disruption for example – which are capable of causing damage in irradiated tissue. HLLT should therefore be used to describe a laser-induced tissue reaction involv-
ing irreversible damage, no matter what mechanism brings the damage about.

**LLLT: Fact or Fiction?**

Several excellent *in vivo* studies have appeared in the literature which argue that there was no effect following experimental LLLT on the animals in the study, with no appreciable difference between the control and experimental animals. The Mester group, on the other hand, produced a volume of clinical and experimental data which showed there was an appreciable effect following LLLT. Who is right? In order to answer that question, I think we have to look at the basic concepts behind the use of LLLT, and what it appears to do. It has been demonstrated that LLLT can have both a stimulatory and inhibitory effect: for example, the excess pigment in naevus spilus can be normalized, while on the other hand normal pigment can be restored to depigmented vitiliginous lesions. The key to this problem lies in the original 'abnormality' of the lesion in question. There really has to be an abnormality before LLLT can be demonstrated to be truly effective. The very act of creating a wound in a laboratory animal is in itself a kind of stimulus: occasionally the stimulus from the wound may be stronger than the stimulus from an extremely low-powered LLLT system. In such a situation it is easy to see why the researcher finds little difference between the control and the experimental group. The artificial creation of an abnormal wound condition is extremely different, since even a scalpel incision or an experimentally-inflicted burn may be looked at by the organism as 'normal' wounds: the 'normalizing' function of LLLT is therefore not apparent. Another mistaken 'control' situation is to produce bilateral wounds on an animal, and irradiate one while using the contralateral wound as the unirradiated control. The excellent paper by Rochkind et al. (Lasers in Surgery & Medicine, 9: 174-182: 1989) shows quite clearly a systemic effect on both the irradiated and contralateral unirradiated wounds on the experimental animals, with statistically significantly quicker healing than the same bilateral wounds on the unirradiated control specimens.

Even in 'normal' wounds scanning electron microscopy studies indicate clearly that enhanced metabolic changes do occur in LLLT-irradiated wounds compared with unirradiated controls. The final outcome of the healing process is usually the same, both in the time period and histological assessment, but all indications point to the fact that LLLT-irradiated wounds are, in the initial stages, in an accelerated wound-healing state, are better vascularized and achieve greater tensile strength with more ordered architecture than the unirradiated control wounds. Surely for the clinician, the most important aspect of these findings is that the wound enters an accelerated healing state earlier, and therefore the risks of possible infection and other complications are less.

An interesting application of LLLT which is being seen more and more is as adjunctive therapy, used together with conventional methodology. A good example is the combination of LLLT with conventional pharmacotherapy such as topical creams and ointments, for example corticosteroids and hydroquinone-based depigmenting ointment. Using the drugs alone can often lead to increased resistance and dependence, requiring higher and higher doses at greater strengths to continue to achieve the same result. It appears that an ideal regimen is to alternate the topical application of the drugs with LLLT sessions applied to the same site. While the patient must attend the therapy centre for the LLLT sessions, the drugs can be applied at home, without the patient's having to travel to the laser clinic. This not only saves the patient time, but also allows a synergistic effect to occur between the LLLT-mediated effects and the chemotherapeutic agent, which has often resulted in decreased dosages and strengths, with better effectiveness of the drug. We on the editorial team would welcome more information on this field for publication.

**WALT Meeting, 1996**

By the time you receive this, the first WALT congress will be almost upon us. I would like to urge as many of you as possible to attend this extremely important meeting, combined as it is with the fourth congress of the International Society for Lasers in Dentistry. Of course I am well aware of the sad problems which have beset Israel in recent weeks. However in conversation with both the Israeli Embassy here and the official tour company handling all the hotel and travel arrangements I am assured that for properly organized tours and meetings, the risk is minimal. If we do not go to Israel because of the terrorists' activities, we are playing exactly into their hands and actually helping them to achieve their goal, and moreover we will not be helping WALT at all. The tour company inform me that they are still sending people on tours in Israel: I therefore hope that we will unite behind WALT, and make this first meeting of the association a well-attended and exciting event. I am looking forward to renewing and cementing old friendships at the meeting, and of course to forging new relationships. As Dr. Mario Trelles said in his Guest Editorial for *Laser Therapy* 7:3, our con-
gresses have two important aspects: the enhancement and augmentation of existing scientific knowledge is extremely important, but the feeling of 'belonging' to a growing and vital association is of equal importance, giving as it does a sense of cohesion to the membership which will only benefit our chosen fields of practice and study. So, let's all meet in Israel!

**1996 ASLMS: LLLT Panel**

By the time you receive this issue, the 1996 sixteenth annual meeting of the American Society for Laser Medicine and Surgery will probably have been held in Lake Buena Vista, Florida. Each year sees an increasing interest in laser therapy, and this year's meeting will feature an open panel entitled *Laser Biostimulation:*

*Fact or Myth.* The panel chairman is Professor G David Baxter, no stranger to this journal, and the panelists are Dr. Jeffrey R Basford, Dr. Bryan Shumaker and myself. It promises to be an 'interesting' meeting, and I am sure I will be able to report on it in a future issue of *Laser Therapy.* Finally, please do not forget that *Laser Therapy* depends on receiving good papers of both a clinical and experimental nature. Kindly bear my earlier words regarding parameters and their reporting in mind, and I hope you will consider this journal when your current LLLT research or clinical project is completed.


*Tochigi, Japan, March 1996*