Can PBM prolong your life?

October 8, 2017, 10:55 am

By Jan Tunér

There is a giant industry behind the “anti-age” concept. But does “anti-age” mean that you can live a longer life? Fillers, botox, implants, skin rejuvenation. Who wants to look old? Most persons obviously do not like wrinkles to indicate wisdom. Fair enough. But “anti-age” more or less means camouflaging the progression of ageing. If you really want to live longer, there are better options such as stop smoking, reduce consumption of alcohol, exercise moderately, reduce stress, read books. Quite inexpensive but more effective.

But what about PBM – can the use of PBM prolong life? Some observations support this supposition moderately. In 2016 Antunes (1) published a study proving that LLLT is not only effective for treating oral mucositis in chemoradiation patients but also very cost effective. The latter conclusion is unusual in the LLLT literature and is a powerful argument for national health care officials. Professor Antunes was awarded the LaserAnnals diploma for “The best LLLT study of the year” (www.laserannals.com/2016/02/06/photobiomodulation-for-oral-mucositis-a-breakthrough).

This year (2017) a long term follow-up study by Antunes (2) also showed that patients receiving LLLT to prevent oral mucositis increased their survival length in comparison to patients not receiving LLLT. The results are summarized as follows: The impact of low-level laser therapy (LLLT) to prevent oral mucositis in patients treated with exclusive chemoradiation therapy remains unknown. This study evaluated the overall, disease-free and progression-free survival of these patients. Overall, disease-free and progression-free survival of 94 patients diagnosed with oropharynx, nasopharynx, and hypopharynx cancer, who participated on a phase III study, was evaluated from 2007 to 2015. The patients were subjected to conventional radiotherapy plus cisplatin every 3weeks. LLLT was applied with an InGaAlP diode (660nm-100mW-1J-4J/cm²). With a median follow-up of 41.3months (range 0.7-101.9), patients receiving LLLT had a statistically significant better complete response to treatment than those in the placebo group (LG=89.1%; PG=67.4%; p=0.013). Patients subjected to LLLT also displayed increase in progression-free survival than those in the placebo group (61.7% vs. 40.4%; p=0.030; HR:1.93; CI 95%: 1.07-3.5) and had a tendency for better overall survival (57.4% vs. 40.4%; p=0.90; HR:1.64; CI 95%: 0.92-2.91). This is the first study to suggest that LLLT may improve survival of head and neck cancer patients treated with chemoradiotherapy.

It is obvious that LLLT added months and sometimes years to those receiving LLLT. It can be assumed that the low incidence of mucositis in the laser group alleviated the pressure on the immune system caused by the chemoradiation treatment and left the patient in a better position after leaving the hospital. A couple of questions pop up after reading this report:

**Does PBM increase life length of an individual?**

Answer: No direct evidence

**Does PBM increase individual cell life?**

Answer: Some evidence

So what is that scant evidence? There is some evidence about the effect on telomeres. Then, what are telomeres? Let us see what Wikipedia writes:
Are we coming closer to understanding some of the mechanisms behind those truly "anti-ageing" effects?

There are many ways to prolong the life of an individual, such as a healthy lifestyle, but the life lottery also includes genes and environmental elements. Genes as well as environment can cause cancer and cancer shortens lives. There has been concern that PBM can stimulate cancer cells but old and new research rather point in the other direction. PBM seems to be able to stimulate the immune system – the best doctor there is. PBM could then develop to be an anti-cancer method, prolonging life.

McGuff (7) reported a cancer-reducing effect of LLLT already in 1964. Ottaviani (8) noted: Laser therapy, recently renamed as photobiomodulation, stands as a promising supportive treatment for oral mucositis induced by oncological therapies. However, its mechanisms of action and, more importantly, its safety in cancer patients, are still unclear. Here we explored the anti-cancer effect of 3 laser protocols, set at the most commonly used wavelengths, in B16F10 melanoma and oral carcinogenesis mouse models. While laser light increased cell metabolism in cultured cells, the in vivo outcome was reduced tumor progression. This striking, unexpected result, was paralleled by the recruitment of immune cells, in particular T lymphocytes and dendritic cells, which secreted type I interferons. Laser light also reduced the number of highly angiogenic macrophages within the tumor mass and promoted vessel normalization, an emerging strategy to control tumor progression. Collectively, these results set photobiomodulation as a safety procedure in oncological patients and open the way to its innovative use for cancer therapy.

PBM may be able to prolong lives by its direct effects (telomeres, improved immune system) but more likely as a support in situations where negative factors can effect life span negatively. Cancer is one such condition, but other conditions such as dementia (9), Alzheimer, stroke, ALS and Parkinson can also reduce life quality and life span (10). The use of PBM for these conditions is still preliminary but promising. And without side effects. HSV-1 is reported to be a contributing factor to the progression of Alzheimer (11). It is well known that PBM, if used at each outbreak, can reduce the incidence or end the eruptions (12).

Are we coming closer to understanding some of the mechanisms behind those truly "anti-ageing" effects?
No Cure from LiteCure

March 22, 2014, 7:59 am

The US laser manufacturer LiteCure (a.k.a. Companion/Pegasus for veterinary version) belongs to a group of laser manufacturers that confuse customers and let consumers pay a high price for something that they do not need. LaserAnnals has previously addressed the so-called Class IV lasers for LPT in general and in a few cases mentioned this particular culprit LiteCure. In this article, we will make a closer check on the credibility and ethics of this company.

Marketing is generally a way of stretching the truth or at least highlighting potential benefits of a product without mentioning the drawbacks. Not very ethical but more or less what consumers expect. Sheer lying is a bit different, and LiteCure uses blatant lies in its marketing. Let us see the first lie:

Lie #1. LiteCure originally claimed that 980 nm has a much better penetration than 808 nm, and that the very high output of their lasers improves the penetration. The illustration below is from their early attempts at marketing the supposed benefits of their device:

Anyone with some basic knowledge about tissue optics knows that 980 nm has a poor penetration due to absorption by water and lipids, and that 808 nm (the illustration actually states 880 nm, but this is not a commonly-used laser wavelength so we assume this was another error…) actually is in an optical window where penetration through skin is optimal. Using very high power with 980 nm doesn’t increase penetration considerably, but instead causes more
light to be absorbed superficially more quickly, leading to heat generation. And LPT is not based upon heat but upon stimulation!

Knowledgeable scientists, experienced clinicians and other manufacturers were quick to criticise, however, and to call LiteCure out on this lie, and over time LiteCure has responded by adding the deeper-penetrating 810 nm wavelength to their products, and by modifying the image, as follows:

Although a step in the right direction, even this illustration is still misleading and, basically, incorrect: The effective depth of laser irradiation does not increase over time.

Further to that, the “effortless” non-contact technique causes considerable energy loss by reflection and backscatter – together, remittance, which has been measured at upwards of 80% from bare skin (Al Watban, 1996) – and up to 100% energy loss due to absorption within animal hair/fur. This is hardly “efficient”!

The truth is the opposite to what their sales claims try to tell: A 0.5 W 808-810 nm Class 3B laser actually has a superior ability to penetrate into the body, whereas a 10.0 W 980 nm Class 4 has limited ability and also causes more problems with regards to heat generation. And, as the lower-powered Class 3B device may be applied in contact with the skin directly over the pathological tissue, and held steady for the necessary time to deliver the appropriate amount of energy, it is also significantly more efficient, accurate and safe.

The problem is that their consumer group is rather ignorant about LPT basics and swallow the bait. Fortunately for LiteCure, very high energies are bio-inhibitory and have a temporary pain relieving effect. This is an impressing effect when demonstrated. The downside of the procedure is that the needed reduction of an inflammatory process in inhibited and so is the body’s ability to regenerate itself. This is what is called "a sales trick".

**Lie #2:** In its advertising material the LiteCure company writes: "World renowned Laser Therapy Experts, Jan Tunér and Lars Hode have indicated the advantages of high power laser therapy. The (research) literature supports the hypothesis that higher power density yields better clinical results."

This is similar to the way the devil reads the bible. The above conclusion follows a part of our book where the remarkably low powered lasers on the Canadian market in the ‘90s is discussed. The vast majority of the lasers used were HeNe 1-2 mW and GaAlAs 5-30 mW. So the 400 mW lasers that had just arrived on the market at that time seemed to have a new potential – and they had.

Continued reading of our book reveals that high energies probably will have a better effect on pain conditions but probably not on superficial conditions such as wound healing. In fact, the discussion following the text about “high power” strongly modulates their usefulness.

This text appeared initially in the 2002 book “Low level laser therapy – clinical practice and scientific background”. In following versions of this book, the text has been modified and becomes more critical of extreme energies. And believe me, the next one will be even more critical, to avoid any misunderstandings.

**Read my lips:** "Tunér and Hode do not recommend 15 W Class IV lasers, not even 5 W!"

An appropriately configured and applied Class 3B device can do all that we need, and if you want to reach deep targets the 904 nm superpulsed GaAs is the best tool!

**LiteCure type of science**

Recently a LiteCure research paper on fibromyalgia (FM) was published:


FM is a devastating condition and LPT is probably a viable option to use, especially since other therapies are rather ineffective and life-long intake of painkillers not a viable option, with the side effects in mind. The study by Panton is obviously performed by a competent team of medical experts, but it seems they have "been taken for a ride" by the LiteCure company. The overall effect of the laser treatment was modest, but had some effects.

So let us have a look on this paper…

**For the laser group, treatment was rendered utilizing a LCT-1000 (LiteCure LLC, Newark, DE) solid-state GaAlAs laser delivering a continuous-wave, dual-wavelength laser with 20% 810 nm, and 80% 980nm at 10 W. Each 56.45 cm2 treatment point was treated with laser at 10.63 J/cm2 and warm air utilizing a grid scanning technique to avoid overheating tissue. Participants were instructed to expect some warmth but that the treatment should not burn and to provide verbal cues if the treatment spots became excessively warm. Each treatment point was treated for exactly 60 seconds for a total of 600 J per point, for a total daily treatment dose of 4200 J. The dual wavelength was used for two reasons: (1) this is what is commercially available and (2) two wavelengths allow for treatment in patients with different skin colours since different melanin concentrations will absorb light differently. Both wavelengths are in the accepted therapeutic window. The sham treatment consisted of 60 seconds of warm air alone over the seven tender points.**

Now, let us try to make some sense about this study:

a. The cause of FM is not known, but it is manifested by painful bodily points. If pain were a separate biological unit, smashing it with a sledge hammer might be useful. But there is probably more to it, like peripheral neural sensitisation and inflammation. 600 J (1) is given to each point and this is a very high and quite inhibitive energy. And a "point" is declared to be 56.45 cm2. This is rather an area. But by spreading out the light over a large area, the dose becomes 10.63 J/cm2. Such a dose appears to be reasonable, but the energy is not.
b. The paper says: Like the IIIIB lasers, recently developed Class IV therapeutic lasers use diffuse light at wavelengths in a therapeutic window that allow penetration of the light deep into the tissue. True, but these lasers do not penetrate deeper than the Class IIIIB/3B lasers, so this is a deliberately misleading statement. Further, Class IV/4 therapeutic lasers are not exactly “recently developed”: The defocused beams of Class IV/4 surgical lasers have been used for therapy for equally as long as Class IIIIB/3B devices. And the first commercially-available dedicated Class IV/4 therapeutic lasers came on the market in Europe during the ‘90s – which, of course, contradicts the claims by LiteCure and others that Class IV/4 laser therapy is new improvement of Class IIIIB/3B. As they are now, these earlier Class IV/4 therapeutic lasers were very expensive and inefficient, and proved no more effective than the already-available lower-powered lasers, so their use did not flourish until the marketing machine took hold in the USA.

c. The paper says: This development has led to the use of Class IV lasers to treat a variety of conditions including skin lesions(24,25), acute soft-tissue injuries (26), and chronic pain syndromes (27) such as FM. In fact, the references 24-27 are not related to the use of “Class IV” LPT lasers at all! This is a technique used often by LiteCure and other marketers of high-powered Class IV therapeutic lasers, banking on the fact that the casual reader will not follow through and actually read the referenced studies.

d. The paper says: There are only a few studies that have used laser therapy to treat pain (16,17,27,37,38). What about 125 published RCTs? If changed to “FM pain”, this is a more valid statement. And one of the most frequently quoted papers on FM and LPT (Gür et al.) used 2 J per point and with better results.

e. The paper says: Studies suggest that Class IV lasers have a beneficial analgesic and anti-inflammatory effect in humans (47-50). No, they don’t! All four papers to which they’ve referred are on Class 3B!

f. Previous studies on FM and LPT have been using considerably lower energies, so the reason for increasing these by a factor 100 seems to have but one background: To prove the superiority of the manufacturer’s product. However, the clinical outcome of this paper was not better than those where is Class 3B lasers have been used.

And let’s address another niggling falsehood: There is no such thing as “Class IV technology”!! 499 mW is Class 3B, 501 mW is Class IV. This is no “technology”. Laser classification is simply related to the relative risk posed by the power, wavelength and distribution of the laser emission!

The manufacturers of the Class IV lasers used in LPT have sponsored a small number of clinical studies. They all contain considerable flaws and even lies and are far from convincing. But they do contribute to the general confusion and are an obstacle in the general acceptance of laser phototherapy.

As mentioned previously, a typical trick of the Class IV vendor is to make reference to Class 3B papers, with proper documentation of their own products lacking. This was the old trick of LED vendors in the ‘90s. The LEDs have, in the meantime, created their own scientific groundwork and do not have to use sales tricks any longer.

You can stop reading here, but if you like, here is the actual text from the book that is supposed to recommend Class IV lasers:

**Stronger = better?**

The power output of therapeutic lasers has increased radically during the nineties. McKibbin reports that there were about 1800 therapeutic laser units in Canada in 1990. 22% of them were HeNe lasers with an output of 1 mW or less, 35% HeNe lasers with 1-2 mW, 13% 830 nm units with an output up to 5 mW, 3% 830 nm units with an output up to 30 mW, 26% GaAs units with an output of 5 mW or less, and 1% units in the 760-780 range nm with an output up to 30 mW.

Now in 2009, the situation is quite different. HeNe units are being replaced by stronger InGaAlP lasers up to 500 mW, GaAlAs units of 7 000 mW are on the market, and GaAs units of 100 mW and more are available.

Even though it is possible to attain some effects with a 1-2 mW laser, there is no doubt that with a laser 100 times stronger, it is much easier to achieve biostimulating effects, at least if one intends to use treatment periods of the same length. Power density is also very important!

The authors used to have certain misgivings about an “inflation” with respect to the output power of therapeutic lasers. One misgiving was, and still is, the obvious risk of eye damage. The need for protective glasses has previously been exaggerated, but is now becoming more important. Another misgiving is the lack of research in the field of “high-power” therapeutic lasers. So far, insufficient data have been published on these powerful lasers. For the moment, we must rely primarily on our own clinical experience. That experience, however, is so encouraging that it cannot be ignored, even with the lack of scientific support. It would appear that “high-powered” therapeutic lasers will be able to further expand the scope of laser therapy, especially in pain therapy.

The doses previously recommended for laser therapy still hold true, in a way. However, much of what we know about dosage is based upon wound healing studies. This is the field in which both stimulating and inhibiting doses have generally been observed. But a wound is superficial, and the superficial tissue will absorb most of the laser energy. So treating a condition in the inner ear through the bone behind the ear is quite a different matter. The dense bone behind the ear absorbs some 90% of the light energy. Skin and blood absorb another 5%. Thus, 100 J in contact mode means only some 5 J or less in the inner ear. For pain and inflammation in large joints, such as the knee, quite a few joules may be required on the surface before the actual target receives the energy needed.

Using the same amount of energy but with different energy densities will not necessarily trigger the same biological response. Kim [545] used 1.2 J in plastic and aesthetic surgery. The energy was delivered either by a 1000 mW or a 60 mW 830 nm laser (1000 mW × 1.2 sec or 60 mW × 200 sec). Both were effective, but the 60 mW laser was more effective in the initial period of wound healing, while the 1000 mW laser was more effective in the late period.

Are strong lasers better than weaker ones?
YES and NO. Output power should not be too low for its purpose. If the power is too low, it causes unnecessarily long treatment time in order to achieve the required total dose (see more about the dose in the next chapter). Also, if output power is too low, it could result in the power density being too low which is an important parameter in treatment. Nor should output power be too high for its purpose. If the power is too high, the light could burn tanned, coloured skin, tattoos or skin with dark hair. Furthermore, in most countries, there is a power limit of 500 mW (= 0.5 watt), above which the laser may be a Class 4 laser. If so, it usually means that it requires oversight by an MD or DDS, more safety measures, and significantly more regulatory control. Also, if the power is too high, it can result in unintentionally high doses which can give less good treatment results than necessary (see the Arndt-Schulz curve in the next chapter). And finally, time is also an important treatment parameter. Administering a certain number of joules over a certain area using a certain laser power during a certain time, may not give the same result as using a ten times stronger laser during one tenth of the time with unchanged optical configuration. Another way to say this is that the rule of reciprocity is not valid. Some laser companies claim that a Class 4 laser ‘by default’ is better than a Class 3B laser (4 is higher than 3, so it has to be better… right?). This is simply not true. The classification of lasers is a measure of eye hazard, nothing else. While defocused Class 4 lasers may well be used successfully in laser therapy, this does not have anything to do with the laser classification.

New Books!

The literature on LPT/PBM is not overwhelming, so all additions of reasonable quality are welcome. Here are a few recent books:

1) Laser phototherapy – clinical practice and scientific background
Price 119 USD. Available from www.prima-books.com

2) Medical Low-Level-Lasertherapy: Foundations and clinical application
Contents: Foundations and basic knowledge of medical low-level-laser therapy, External laser therapy and laserneedle acupuncture, Transcranial laser therapy, Interstitial and intra-articular laser therapy, Intravenous laser therapy, Photodynamic (tumour) therapy, Dermatology and skin rejuvenation, Weight loss (body contouring), Lasers and stem cell therapy. Detailed treatment protocols (general rules regarding intensity, choice of wavelength (colour), treatment duration etc. as well as specific protocols for different indications)
Price: 180 € (plus freight). Orders: weber-research@isla-laser.org

3) Handbook of Photomedicine
Not focused on LPT but contains some excellent chapters in this field. £134.00
http://www.crcpress.com/product/isbn/9781439884690

4) Lasers in Dentistry – Guide for Clinical Practice

5) Intravenous Laser Blood Irradiation
Michailov V. 2007. 100 pages, paperback.
Not new, but new to us. Can be ordered from Vladimir Michailov, mlasass@mail.ru
6) Laserterapi – en praktisk guide

Normally, we only feature books in English. However, if you are living in Scandinavia and working with LPT, this Swedish language book is a must. Written by the Swedish physiotherapist Cecilia Lind, this book covers theory as well as clinical practice in a very didactic way. 160 pages, beautifully illustrated.  
http://laserguide.se

7) Low Level Laser Therapy for Physical Therapists: Skills Development

A new book on PBM in physiotherapy has been published by the Indian physiotherapist Malini Chaudri, available at:  
PBM – PhotoBioModulation – watch out for it!

By Jan Tunér

Ever since the birth of “low level lasers” there has been no consensus about the vocabulary in this kind of medical intervention. MeSH terms of the National Library of Medicine's controlled vocabulary thesaurus contains several terms:

- LLLT;
- Laser Biostimulation;
- Laser Irradiation, Low-Power;
- Laser Therapy, Low-Power;
- Low-Level Laser Therapy;
- Low-Power Laser Irradiation;
- Low-Power Laser Therapy;
- Laser Phototherapy.

All in all nine names! These terms are important for indexing on PubMed. Searching for any of them means you get the whole bunch, because all “LLLT” studies are indexed with all these terms. It is important to note that there are several other names (e.g. LILT) around, not indexed by MeSH, so the situation is complicated.

All these names have their pros and cons and there has been an ongoing discussion about a choice of a common name, but everybody seems to stick to his own darling. At the 2014 joint congress of NAALT and WALT, an expert group of 15 internationally recognized scholars decided to suggest “PhotoBioModulation therapy” (PBM) as a new and general term. Adding to the confusion or getting rid of the confusion? I go for the latter, even though I used “Laser phototherapy” in my recent book. I liked “phototherapy” and to add the light source in front of it. An important problem with PBM is that it is not indexed by MeSH, and therefore not very useful. But no longer! From November 2015 PBM is added to the above list and my recommendation is that we all kill our darlings from now on and stick to this new term. With PBM we get rid of the question “what is low” and what does “level” mean. PhotoBioModulation correctly describes what we are doing – modulating cellular events with light. Many types of light can be used, not only lasers, although lasers do have several non-replaceable advantages. The term LPBM (laser PBM), LEDPBM, broadband light PBM etc. can be used to specify the light source used.

Further to that, we get rid of “biostimulation”, because what we do with the therapeutic lasers is not only stimulating but, when so called for, inhibiting.

So I go with Churchill: “It has been said that democracy is the worst form of government except all the others that have been tried.” Quote Tunér: PBM is the
worst term except for all the others that have been used!

Now, on the subject of MeSH, I disagree with this very influential agency when it comes to describing PBM (sic!):

*Treatment using irradiation with light at low power intensities and with wavelengths in the range 540nm-830nm. The effects are thought to be mediated by a photochemical reaction that alters CELL MEMBRANE PERMEABILITY, leading to increased mRNA synthesis and CELL PROLIFERATION. The effects are not due to heat, as in LASER SURGERY. Low-level laser therapy has been used in general medicine, veterinary medicine, and dentistry for a wide variety of conditions, but most frequently for wound healing and pain control.*

The upper limit at 830 nm is of course not correct, PBM effects have even been documented with defocused CO$_2$ lasers! The NAALT/WALT committee suggests a new definition:

*A form of light therapy that utilizes non-ionizing forms of light sources, including lasers, LEDs, and broadband light, in the visible and infrared spectrum. It is a non-thermal process involving endogenous chromophores eliciting photophysical (i.e., linear and nonlinear) and photochemical events at various biological scales. This process results in beneficial therapeutic outcomes including but not limited to the alleviation of pain or inflammation, immunomodulation, and promotion of wound healing and tissue regeneration.*

Are we seeing the beginning of the end of the nomenclature problem?

2014 NAALT/WALT Nomenclature Consensus Committee

Clockwise from left: Juanita Anders (Chair), Jan Bjordal (Co-Chair), Lars Hode, Peter Jenkins, Gerry Ross, Donald Pathoff, Nicolas Wise, Jerry True, Praveen Arany, Roberta Chow, Anita Saltmarche (standing), David Baxter, Patricia Trimmer, James Carroll.

Where's the harm in hype?

February 19, 2017, 8:13 am

By Peter A. Jenkins

I recently came across an article on the ‘Science-Based Medicine’ website, and in it I found the following statement relating to the often-large disconnect between the evidence and the marketing claims in relation to ‘Whole Body Vibration Therapy’ (WBVT).

“As is often the case, there is the science of WBVT and its ethical incorporation into medical practice, and in this case also physical therapy and fitness, and then there are the claims that are made for WBVT by companies selling equipment. Not surprisingly, the commercial claims significantly outstrip the evidence.”

In essence, this is exactly the same point that, as readers of The Annals will recognize, we have made repeatedly in relation to our own field of photobiomodulation (PBM) therapy (PBMT).

*As is often the case, there is the science of PBM and its ethical incorporation into [physical therapy and medical, dental and veterinary] practice, and then there are the claims that are made for PBMT devices by companies selling equipment. Not surprisingly, the commercial claims significantly outstrip the evidence.*

Again, “...commercial claims significantly outstrip the evidence.”. But this does not mean there is no evidence: We actually have a huge body of mechanistic and clinical evidence from over 50 years of PBM research and practise, and although further research will always be needed to identify additional mechanisms and potential applications, and to optimise parameters, our current knowledge of PBM is more than sufficient to support its potential use across a myriad different indications.

It simply behoves the clinician and, indeed, the patient to look beyond the marketing hype to see whether any of this evidence supports the use of PBM, whether alone or in combination with other interventions, for a specific indication or outcome.

However, and unfortunately, in the drive to increase profits and sell more devices than their competitors, commercial entities are putting up a smoke screen of overly-hyped claims and counterclaims, making it harder to identify the ‘true’ facts and actual evidence. As a result, PBM is often applied with less-than-optimal, or even incorrect, parameters or with inappropriate devices, or used in cases where PBM is not even indicated.

Creating such an environment opens the door to broader criticism and distrust, and makes it even more difficult for us to have PBM be accepted for what it can truly offer.
Hype is harmful, and anyone indulging does a disservice to both clinician and patient, and to the industry as a whole.

FREE Educational PBM Site

June 21, 2017, 7:28 am

LaserAnnals.com is proud to announce its cooperation with the new free educational site, LaserLessons.info!

This site offers ten basic educational documents on PBM as on Open Access option. Where applicable, more complex explanations are additionally linked to one of the more than 100 LaserAnnals.com articles on the subject.

If you like this initiative, we invite you to add a link on your own web site or to share this information on your social network.
Low-level laser therapy (LLLT) is one of the most common methods of physiotherapy, which is the modern stage in the development of heliotherapy and light therapy. At the end of the 19th century, Nobel laureate N.R. Finsen proved that it is possible to significantly increase the effectiveness of light therapy by using “special” lamps instead of sunlight, so that one is able to control their power, area, exposure time and is also able to allocate the desired spectrum of light. In the early 1960's, lasers appeared on the market. They were sources of monochromatic light (therefore, it is not necessary to use light filters to isolate a part of the spectrum), whose energy parameters were much easier to control. These qualities led to the emergence of a fundamentally new direction – low-level laser therapy, which is characterized by its higher efficiency and universality [Moskvin S.V., 1997].

Exposure to low-intensity laser illumination (LILI) causes a reaction in the body, and as a result, homeostasis (which was disturbed beforehand) is restored, resulting in the recovery of the patient. After absorption of laser light in the cells, Ca²⁺-dependent processes are the first to activate, launching numerous secondary reactions at the tissue and organism level (Fig. 1) [Moskvin S.V., 2008, 2014, 2016, 2017].

LLLT used successfully in almost all areas of modern medicine:

- obstetrics and gynecology [Fedorova T.A., et al., 2009];
- andrology and urology [Ivanchenko L.P., et al., 2009; Mufaged M.L., et al., 2007];
- neurology [Kochetkov A.V., Moskvin SV, 2004; Kochetkov A.V., et al., 2012];
- otorhinolaryngology [Nasedkin A.N., Moskvin S.V., 2011];

The development of medicine in the context of globalization is impossible without the exchange of information coming from different countries. This allows specialists not only to get acquainted with new medical technologies, but also to more objectively evaluate their own achievements. If some methods allow you to get better results, why not try it, especially when aware of the known limitations of “conventional” treatment regimens. Conservatism is necessary in medicine as it is anywhere, but the artificial limitation by the framework of the customary does not allow its developing.

Many methods of treatment offered by specialists from different countries are quite unique, as they developed in conditions of political and linguistic isolation. From the point of view of their authors, the good results which are demonstrated by them, and even the remarkable results of the treatment, allow the technique to be distributed automatically throughout the world. However, very often this opinion is only based on many years of successful experience of practical application, even in several clinics, but not on data of standardized studies. In addition, in most cases there is no theoretical justification, an explanation of the mechanisms of therapeutic action. Therefore, their value for science world and medical practice is often questioned.

On the other hand, the rejection of unusual (non-standard, non-traditional) methods of treatment, in turn, is almost always justified by phrases such as “I do not believe” and “this cannot be”, rather than scientific (objective) evidence of an absence or presence of a therapeutic effect. Once upon a time LLLT was referred to as “voodoo medicine” [Coulter A.H., 1994], in the 1980’s-90’s, conferences did not accept reports on the therapeutic use of lasers, and we listened to the ridicule from foreign colleagues. While laser surgery was easily accepted because everything was “clearly understood”, laser therapy was denied even with the theoretical possibility that LLLT may have any influence on a living organism [Berlien H.P., Müller G., 1989].

Except for subjective factors, there are two main objective reasons at the basis of this mistrust. The first of them is – in many aspects – the fundamental differences in scientific medical education.

One syllabus of education can be generally referred to as the “Western School (WS), where students learn more about the specifics of everything, and “disassemble” a person into organs, specialized cells, cell organoids, molecules and atoms. Accordingly, diseases are classified by organs and targets that have been pathologically affected, and almost all treatments are based on the principle of substitution and external compensation. For example, a tooth that has fallen out – the necessary way to treat this is to implant an artificial tooth. The body cannot cope with an infection – antibiotics must be used to kill the bacteria.

This approach has been developed over several centuries in Europe, although not without professionals opposing this in favour of another point of view. Even at the stage of the formation and development of modern medical science in WS’s, there were fierce debates about the approaches to the studying of structures and principles of the existence of living objects, as well as the fundamental basis of treatment, which was perfectly reflected in the immortal work of the great German poet (Goethe J.W. Faust: a tragedy. Translated, in the original metres, with copious notes, by Bayard Taylor, London: Ward, Lock, and co., 1890, p. 71):

He who would study organic existence,
First drives out the soul with rigid persistence;
Then the parts in his hand he may hold and class,
But the spiritual link is lost, alas!

In studying only the “build” of a living being from which it consists, without constantly correlating the knowledge gained with the general laws of the functioning of the biological system as a whole (basically, without studying the larger picture that is life), there is very little useful information which is learned. This situation was described very accurately by the remarkable American science fiction writer Harry Harrison: “Facts for them were always hooked up in a series. Whereas in truth they had to be analyzed as a complex circuit with elements like positive and negative feedback, and crossover switching. It’s little wonder they did do badly.” (Harrison H. The K-Factor – 1960, p.11)

Nevertheless, it is necessary to admit the obvious, WS has given the world thousands and thousands of highly effective treatment technologies, thanks to which the quality and duration of life of people in those countries that use this technology. The older generation live a full life, rather than simply “surviving” their century. This is all thanks to science and research, conducted by scientists of various profiles.

The second direction of medicine is the “Eastern School” (ES), in which a patient is treated as a whole and is not treated based solely on the disease, more often using non-specific methods of treatment, and at the core of their restoration is the disturbed ability of the body to protect and normally regulate various physiological processes. For example, instead of antibiotics, we restore the body’s ability to normalize (activate) the patients own human immune system.

If in the WS more they study the “device” of living, what the bio-object consists of and how the different parts interact with each other, the ES studies the “function” of the living system as a whole, the laws of its response to external influence. For ES, the word “science” has a special meaning, the response of the biological system to external influences is studied, primarily from the position of sanogenesis, i.e., the ability of the living organism to independently fight the disease by activating internal functional reserves.

The most striking example of medical technology in this area is acupuncture, in which, for therapeutic purposes, effects are exerted on certain points on the human or animal body, causing the necessary response of the organism. These “biologically active” points and the necessary sequence of effects on them
were determined empirically. Despite the fact that these local zones are not morphologically different from surrounding tissues, and the mechanism of healing is not only unknown, there aren't even any theoretical ideas, this method is quite common. The reason for this is its effectiveness in most cases.

One of the problems for ES is that its representatives very often use non-standard, terms that only they themselves understand to describe their medical technologies, and they do not bother explaining the mechanisms or scientific justification of how all this “works”. For example, acupuncture uses concepts such as the Five Element System (Fire, Earth, Metal, Water and Wood) and Meridians. It is quite understandable that such an approach often causes rejection by WS specialists.

Recently, due to the clearly observed tendency to blur the borders between East and West, the ES’s views are gaining an increasing understanding among Western doctors. For example, in English there are quite a lot of scientific journals on acupuncture that have gained the attention of many readers, and a high enough IF (Impact factor) (For example, Acupuncture in Medicine, http://aim.bmj.com).

In our opinion, in each of the directions, both WS and ES have its pros and cons, but one must take all the good and ignore all the bad in both schools.

Low-level laser therapy is a vivid example of highly effective medical technology, and despite being successful, to the ES it is completely unclear technology. Unlike many other therapeutic methods of ES (even acupuncture), we have rigorously demonstrated the mechanisms (primary and secondary – see Fig. 1) underlying the method, and understanding of which, in turn, allows us to not only explain the numerous experimental and clinical data, but also to substantiate the most effective parameters of treatment methods, as well as ways to optimize them. In LLLT, when describing techniques, only standard terms and definitions are used that are familiar to all WS representatives. The effectiveness of laser therapy has been proven in the course of tens of thousands of clinical studies.

Low-level laser therapy is a perfect example of a close interaction between WS and ES specialists, which resulted in the birth of a new, remarkable, extremely effective, simple and reproducible treatment that has no side effects and contraindications in many diseases, a large part of the diseases according to the WS canons, with the use of standard WS schemes are “not treatable”.

It is, of course, necessary to apply LLLT correctly, and it is very easy to do this. We developed strict recommendations, standard methods and principles for their optimization, which allows specialists of all types to treat their patients easily and effectively [Moskvin S.V., Kochetkov A.V., 2017].

1. For low-level laser therapy only lasers can be used, not light bulbs or LED’s. [NB. By definition, this is true. However, other monochromatic light sources can be used effectively for photobiomodulation, of which LLLT is a sub-set, if the parameters are also appropriate. (PAJ, Ed.)]

2. In the methodology it is necessary to consistently set all parameters: wavelength, operating mode (continuous, modulated, pulsed), laser light power (average or pulsed), frequency for pulsed or modulated modes, exposure, localization, number of procedures per course. Area of illumination (and the energy density) is distinguished by special nozzles. If even one of the parameters is set incorrectly, the technique will not be implemented, the effect will not be reached.

3. All the selected parameters should be exactly optimal, for example, increasing the laser power does not always lead to an improvement in the result, it often becomes worse.

4. When the frequency is changed for pulsed lasers, the average power also varies proportionally. This allows you to select the optimal energy parameters, which cannot be realized for continuous lasers and modulated mode.

5. It is strictly forbidden to illuminate one zone (point) for more than five minutes, and the total time of the procedure should not exceed 20 minutes!

The 2nd principle requires some clarification. In laser therapy, there is no such parameter as “dose” or “dosage”. There is “energy” = power ´ time [J] and “energy density” = energy/area [J/cm²]. The arithmetic demonstrations are absolutely not necessary! Let us give an example. The ED may be the same (most often the optimal 1J/cm²) in three different situations (assuming a contact-mirror technique and an effective area of 1cm²):

- the power of 1mW is multiplied by the exposure time 1000 seconds (about 15 minutes) = 1J/cm²;
- the power of 1000mW is multiplied by the exposure time 1 second = 1J/cm²;
- the power of 10mW is multiplied by the exposure time 100 seconds (about 1.5 minutes) = 1J/cm².

But the effect, i.e., a positive result of the treatment, will be ONLY in the 3rd case, when all the optimal parameters are set, and even then, only for lasers of continuous operation with a wavelength of e.g. 635nm (red spectrum). In options 1 and 2, there will be no curative effect for any laser or mode of operation!

There are other recommendations that specialists in Russia are studying at specialized courses.

Analysis of different periods of development of LLLT allows us to conclude that its capabilities are still inadequately used, and there are all prerequisites for the active development and expansion of the application. This opinion is supported by the fact that only in 2016 more articles have been published in English-language journals than in the whole period since 1965 (the first reports) until 2000. Despite the fact that in the overwhelming majority of cases, the quality of publications is extremely low (this fact deserves a separate and detailed discussion), the positive trend is encouraging.

References

PBM? Do you have any scientific references for your claims?

By Jan Tunér

Not too seldom, non-believers in PBM will ask for references, having difficulties in accepting what you say. Providing such references can take time and you may not be too used to collect them or to know where to find them. Below, then, is a brief selection of recent studies. First, there is a “short-list” of PMID numbers.


Mechanisms


Carpal tunnel


Sports Medicine


Arthritis


Nerve Function and Repair


Tendinitis


Lymphology


Oncology


Aphthous Stomatitis


Herpes Simplex, HSV-1


Bone regeneration


Wound Healing


Neuralgia


Spanenberg JC, López López J, de Figueiredo MA, Cherubini K, Salum FG. Efficacy of low-level laser therapy for the treatment of burning mouth...
Facts and myths about Low-Level Laser Therapy

January 14, 2018, 12:58 pm

By Jan Tunér

There are many myths and city tales about LLLT/PBM. Let us have a look on some of the most common ones!

Magnets

There are lasers where the light is combined with a magnet. Magnets may or may not have a beneficial effect on things like inflammation and pain, but there is no evidence for any positive effect when these two therapies are combined. And the depth of penetration is not affected at all, the photons are not affected by the magnetic field.

Pacemakers

This misconception seems to have eternal life, no matter how often it has been refuted. When low level lasers were initially introduced, they were obviously included into the safety requirements of electrotherapeutic devices. But lasers are based upon light, not electricity. Pacemakers cannot be influenced by light. Full stop. [NB: There are some devices on the market that combine ‘multiple radiance sources, such as static magnets and/or pulsed magnetic fields, and/or electrical stimulation, with laser and/or LED sources in the application head (see e.g. ‘Magnets’, above). Whilst the light-emitting components will not affect the performance of a pacemaker, the safety of these specific multi-radiance devices should be considered on the basis of these additional energy sources. (PAJ, Ed.)]

Solitons and scalars

There are many “home tailored” theories in the market. Some stem from alternative medical circles where auras, levitation, homeopathy are cherished. “Soliton waves” and “scalar waves” are a couple of home tailored fabrications and do not exist in PBM units at all.

http://www.laserannals.com/2016/02/06/the-end-of-the-soliton-laser/

Diabetes

There are so far only some suggestions that PBM could reduce the development of diabetes. But there is evidence that PBM can reduce a very serious side effect of diabetes: impaired wound healing.


Penetration

There are many opinions about the penetration of light. From 13.5 cm to 2 mm. Most of the claims are incorrect or incomplete. The penetration differs with the wavelength, with the type of tissue and with the technique used (irradiation from a distance, contact, firm contact). Be critical about too optimistic claims, and stay convinced that laser therapy cannot be performed through clothes. And do not believe that 980 nm can penetrate deeper than 808 nm.


Green laser pointers

Newspapers, ophthalmologists and even government officials often claim that the green laser pointers can make a person blind. If we limit ourselves to 90% of incidences with “green laser attacks”, these lasers are in the range 5-100 mW and are harmless for the eye. To hit the eye of a car driver arriving at some 50 km/h more than a millisecond is hardly possible. But it is very irritating and distracting and very bad for traffic safety. To ban them is correct, but rest assured that your eyes are safe. The remaining use of high power green laser attacks is another matter. But still not as bad as press report tend to suggest.

Eye safety

Class 3B laser are uncollimated and safe. Using protective goggles on the patients serves three purposes: suggesting high tech, making the patient feel safe and complying with governmental requirements. There are no verified reports about ocular injuries caused by 3B lasers.

http://www.laserannals.com/2016/02/06/637/

Pulsed or not pulsed

Some manufacturers claim that certain pulse repetition rates are favorable for certain biological conditions. Maybe so, but right now we know very little about this and the “recommendations” are personal guesswork. Some lasers are pulsed out of necessity to reduce heat accumulation in tissue and some are pulsed to save the diode from overheating (GaAs lasers for instance).

Radiation therapy

Patients subjected to radiation therapy should not be subjected to laser therapy, according to some sources. This belief was proven wrong already in 1965 and the evidence tells us that PBM is the best method possible to avoid the side effects of radiation therapy such as mucositis and xerostomia. http://www.laserannals.com/2016/02/06/photobiomodulation-for-oral-mucositis-a-breakthrough/

Cancer

Only oncologists are legally allowed to treat cancer. Fair enough. But suppose there is an unknown malignancy in the area? Research shows that cancer cells can be stimulated in vitro (alone in a Petri dish) but in vivo there is the immune system working the other way around. And PBM stimulates the immune system. http://www.laserannals.com/2015/09/05/559/

Pregnancy

Some sources claim that PBM should not be used on pregnant women. Nobody has even provided any support for this claim. Acupuncturists claim that there are “forbidden acupuncture points” over the abdomen. For safety reasons only, these could be avoided but other than that the fetus should benefit from a mother without pain or inflammation.

Thyroid gland

Irradiation of the thyroid is a case for the specialist, but the fear of letting laser light occasionally cover the thyroid is exaggerated. In some cases, it has even been an effective treatment method. http://www.laserannals.com/2013/03/24/lpt-contraindications-some-facts-and-some-myths/

Light sensitivity

Claims have been seen that light sensitive patients should not be treated with PBM. For instance, patients taking St. John’s-wort. This is probably true for wavelengths below 500 nm but there are no reports of such a phenomenon when wavelengths in the PBM range (600-1100 nm) have been used.

Epilepsy

Pulsing light can trigger an epileptic attack, this is well known. But if the patient cannot see the light? Evidence supporting this concern is lacking.
People hearing about the potential of PBM can be a bit skeptical. From the very beginning, the least skeptical persons were those already convinced about the
magic of crystals, auras, healing and homeopathy. The strong placebo effect of such therapies should not be underestimated. In the PBM industry there are also that kind of people, believing in the magic of the light. But just as in the general alternative medicine, there are naïve believers and cynical conmen. The difference is often hard to tell. The reader is here left to judge for himself about the claims on the website of "Biolight Technologies". Fantastic possibilities in medicine are offered by a 635 nm collimated laser of 5 mW. This looks like a traditional laser pointer with the difference that this beam is pulsed.

"The Aura PTL II" is said to be the only laser available that combines: "Hz and substance-specific frequencies, Low Level Laser Light, Acupoint Stimulation, Homeopathy, Whole Food Nutrition. And it is the ONLY low level laser therapy with: thousands of frequencies, extensive treatment capacities, energetic information induction, acupoint stimulation, integrated protocols, homeopathy and whole food nutrition, the power of wellness in the palm of your hand.".

And: "The PTL Home Laser is 2 to 4 thousand times more precise than any other laser in its class on the market today". Further, the web site promises that "Science has documented that the regular use of true Low Level Laser Therapy can significantly reduce your risk of developing many types of degenerative diseases such as Neurological Conditions, Alzheimer's, Impaired Memory and Lack of Mental Clarity. The Home Therapy System has brain and neurological programs that are designed to help keep your mind and nervous system functioning at a higher level of performance. The Aura PTL Home Therapy System is truly the best Health (brain) Longevity Insurance anyone can possibly buy.".

So, what is the difference between this miracle product and a USD 5 laser pointer? According to the website, "They are two very different light sources and cannot be compared. Our equipment is designed to support and encourage the innate healing abilities already resident in our bodies. The body is a very precise organism and it requires a very precise instrument to treat it. We use the highest quality 635 nm semiconductor laser diodes. the highest quality collimation lenses to prevent energy pollution."

So far, a lot of diffuse words known from quackery, and a lot of unsupported claims. Yet another fantastic claim is: "This is the light source used for the tens of thousands of research studies performed over the past 60 years, and it is the source of light used to create photobiomodulation, a true natural physiological dose of healthcare. Few other LLLT providers use this form of energy; instead, they opt for the politically correct westernized allopathic forms of laser application such as high power infrared and ultraviolet. The last 60 years of research has not supported these methods of laser application, while it has supported the type of low level light therapy that the Aura PTL II uses."

Where are the tens of thousands of studies using 635 collimated laser light? There are more than 5000 LLLT papers in total and most of them are using IR light, and very few indeed ultraviolet. And despite the lack of scientific support, there are "3000 recipes and 200 integrated protocol" in the product. In the opinion of the manufacturer, infrared light is of no value.

One "Dr. Graham" writes about LLLT on the website, presenting a lot of mumbo-jumbo. Among other things that lasers not being expensive 635 nm laser pointers are actually some sort of LEDs.

How can you debate with such obvious nonsense? Is it even worth taking the debate? I limit myself to this quote:

"A lot of fuss for little wool", said the farmer shearing the pig.
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