

## Low-Level Laser Therapy May Have Cancer Fighting Role

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IT WAS IN July 1963, at the Second Laser Conference, Northeastern University, held in Boston, Massachusetts, that Paul McGuff and colleagues presented a study showing specific effects of laser on cancer for the first time. In the study, published in October that year, the authors conclude:

“It would appear from the experimental data that the Laser has a selective effect upon tumors, since the treated tumors were destroyed while the adjacent normal tissue was relatively unaffected. The effects of the Laser appear to be both immediate and delayed. This is indicated by the observations that the destruction of the tumor is progressive over a period of several weeks.”

Hence, the first studies on effects of laser light on soft tissue, and on cancerous tumors, date back more than half a century. Several studies, both *in vitro* and *in vivo*, have been carried out. Lasers have also been used to excise tumors, as well as to coagulate, vaporize, denature, or simply heat them up.

Low-level laser therapy (LLLT) or photobiomodulation is a nonthermal therapy using laser light in visible to near infrared range. It is well known to accelerate wound healing and reduce pain and inflammation. However, treating cancer patients with laser, without irradiation of the tumor or surrounding tissues—that is, by systemic laser treatment alone—appears not to have been studied more in depth.

The Swedish Laser-Medical Society is a forum for practitioners working with laser medicine: LLLT, laser surgery, and laser for aesthetic purposes. About 15 years ago, we heard rumors that people with cancer had been treated with LLLT and that the results were unexpectedly positive. We did not take these rumors seriously, but regarded them as anecdotal or tall tales.

Over time, we have received more and more reports from both practitioners and patients, so we decided to investigate these claims in a serious way. We have found that most of the treatments performed were not about the cancer itself but usually about the spine and lymph nodes. We have now been able to study many patient records and believe that LLLT may play a role in fighting cancer.

Recently, we received the following e-mail from a member practitioner: “I have a patient whom I have treated for over a year. It was originally breast cancer that had spread to the skeleton and liver. We’ve treated her once a week for a year and she is in amazingly good condition and her samples show considerable improvement. The immune system is holding up well and she can now tolerate more chemotherapy.”

So far, a few hundred people, with or without parallel conventional oncologic treatment, have received LLLT at their own expense. We have estimated the doses per treatment to be 100–800 J of 904 nm super pulsed GaAs laser, combined with 50–100 J of 650 nm InGaAlP laser or 633 nm continuous HeNe laser. We do not know what might be an optimal dose or combination of parameters, but the concept seems to work.

Since to our knowledge no double-blind placebo-controlled studies have been performed, we plan to carry out one. We want to study the effect of LLLT in combination with chemotherapy in patients with metastatic HER-2 negative breast cancer. We will take repeated tumor biopsies and do imaging tests as well as taking blood samples before, during, and after treating the patients. We will also analyze molecular changes in the tumor cells and their microenvironment, as well as any immunological changes reflected in the tumor and the blood induced by the addition of LLLT.

Apart from clinical efficacy, we will also study safety and tolerability of the combined treatment. As many of these patients experience that LLLT treatment has improved their well-being, we will also analyze possible correlations between clinical efficacy and quality of life (QoL) [QLQ BR-23 (Quality of Life Questionnaire, Breast Cancer Specific module)].

However, this is easier said than done. We started planning a double-blind study with 100 patients and estimated the cost to be around USD \$5 million. We talked to a major cancer foundation and they said: “Show us a large pilot study and we might consider supporting the project.” So, now we plan to do a cohort study with less MRI and fewer blood samples that we hope to be able to finance, one way or another.

What about risks?

LLLT has been used successfully for the prevention and management of complications after surgery, chemotherapy, and radiation therapy. But in general it has been withheld by practitioners because of the fear that LLLT might result in the initiation or promotion of metastatic lesions or new primary tumors. Because of this, there has been little scientific study of oncologic outcomes after using LLLT in cancer patients.<sup>1</sup>

To get an idea of LLLT treatment and possible risks, I have chosen a few studies of interest.

A study, investigating whether LLLT would promote tumor growth in cases of pre-existing malignancy, came to the

conclusion that LLLT with the used parameters may be safe under such conditions when malignant lesions are present.<sup>1</sup>

In a double-blind study of laser treatment of mucositis, the results indicate lower morbidity in the laser group, and that LLLT was more cost-effective than placebo.<sup>2</sup>

A meta-analysis, including 1144 patients, concluded that prophylactic LLLT reduced severe mucositis and pain in patients with cancer.<sup>3</sup>

In a study investigating the immunological changes induced by interstitial laser thermotherapy (ILT) on long-term outcome of patients with invasive breast cancer, 24 patients were treated and followed by standard surgical excision. Immunohistological reactions on immunocompetent cells were performed on specimens obtained before and after ILT. Follow-up time was 116 (range, 91–136) months. In conclusion, ILT did not have any long-term adverse effects.<sup>4</sup>

In a study using GaAs laser with a frequency up to 3000 Hz and peak power up to 5 W, in combination with surgery, the researchers summarized:

LLLT decreased postoperative complications by 15.3% and also decreased the duration of lymphorrhea. The rate of patients with stage 2 breast cancer who survived 5 years after being treated with LLLT was 100% (85.71% in the control group). The rate for the patients with stage 3 breast cancer treated with LLLT was 94.44% (78.94% in the control group). Altogether, 91.3% of patients with stage 2 breast cancer treated with LLLT had no 5-year recurrence.<sup>5</sup>

In summary, in this context, LLLT has proven to be a very safe and painless treatment. Although it has been shown that cancer cells can be stimulated in some *in vitro* studies, this is not tantamount to concluding that cancer cells in living creatures, after laser treatment, can cause or aggravate a cancer. The difference is of course that a human

being or an animal, in contrast to a cell culture, is equipped with an immune system.

One clear cut observation that we made interviewing cancer patients is that they reported a significantly higher QoL after LLLT therapy, something that is especially important when fighting a life-threatening disease.

## References

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