INTRAVENOUS LASER BLOOD IRRADIATION IN SPORTS MEDICINE

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Introduction

Our idea to test the application of intravenous laser blood irradiation in sports medicine started in July 2007, when a young patient of ours told us he was having surpraising effects since he had started the treatment.

He was a male, aged 34; he had come to our medical center for a problem of tinnitus. Illness was started 1 year before and he had undergone many diagnostic examinations (MRI, doppler, CAT), but they were all negative. In the previous year, he had had a three months treatment with cortison, without any success. He was not taking any drugs nor any kind of therapy at the moment we visited him.

The following treatment protocol was used:

- Intravenous Laser
- Laser shower (locally)
- Lipoic Acid (400 mg/die) and Ascorbic acid (100 mg/die), in order to enhance cellular methabolisms.

After a 10 sessions treatment, tinnitus was lowered (about 50%), but did not disappear.

Nevertheless, the patient experienced some interesting and unexpected "side effects": he told us he was feeling less tired in the evening, that his sleeping was improved and he referred a better concentration during the day. But, what is very important, is that he was an athlete (body building) and he had noticed that his maximum lifting power was increased, the running time in the training session was doubled and the number of swimming lanes in the training session was increased. Also his trainer was surprised by his improvements.

Many scientific papers have been written so far, showing biological actions and therapeutic properties of intravenous laser blood irradiation; this new medical technology is currently used for the treatment of different pathologies like rheumatic, cardiovascular, pulmonary and neurological diseases. But, to our knowledge, no scientific works have been performed, so far, about laser blood irradiation in sports medicine.

So, we decided to perform a short study, in order to confirm the effects that had been observed in our patient.

Materials and methods

Study population

4 male body building athletes were enrolled in the study. Mean age was 23,2.

Treatment protocol

All athletes underwent 10 sessions of intravenous laser blood irradiation, with the following treatment schedule:

- 630 nm, 2 mW, 20 min. (first session);
- 630 nm, 2 mW, 20 min. + 532 nm, 2 mW 10 min. (9 sessions).

3 sessions per week were performed.

All athletes were invited to avoid any drugs or vitamins during the period of study.

Outcomes

The following outcomes were measured:

–Maximum strength tests:

1. Pectoral muscle maximum lifting power. Weight is lifted in the supine position, while athlete lies on the bench (Fig. 1). Maximum weight had to be confirmed by 8 following lifting of sub-maximal weight (80% of maximum).

2. Weight lifting from the floor. Weight is on the floor and athlete has to lift it from standing position (Fig. 2). Maximum weight had to be confirmed by 8 following lifting of sub-maximal weight (80% of maximum).

3. Squat. Weight is put on athlete's shoulders and athlete has move down and up, once. Maximum weight had to be confirmed by 8 following lifting of sub-maximal weight (80% of maximum).

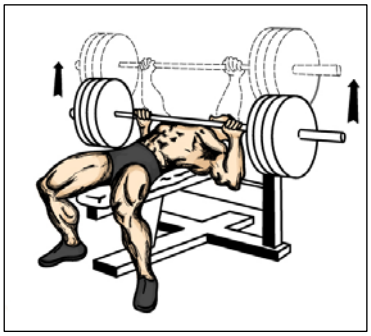

Fig. 1 – Pectoral Muscle maximum lifting power

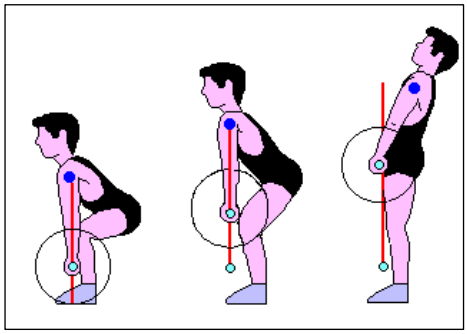

Fig. 2 – Weight lifting from the floor

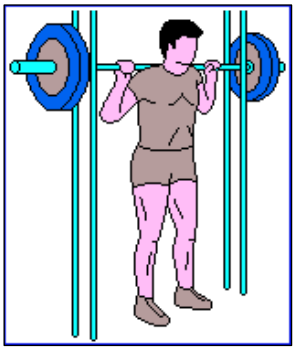

Fig. 3 – Squat

–Endurance tests:

1. Nr. of swimming lanes. Is the maximum number of swimming pool lanes that athlete could perform until he felt tired. This test is not time dependent.

2. Cord jumping. Is the maximum time that athlete could perform in cord jumping until he felt tired

Measurements:

All athletes were evaluated in 8 different times of the period of study:

1. before the treatment,

2. after the treatment,

3. every 4 weeks after the end of the treatment.

Results

Mean pectoral muscle maximum lifting power at any time of measurement is shown in Fig. 4.

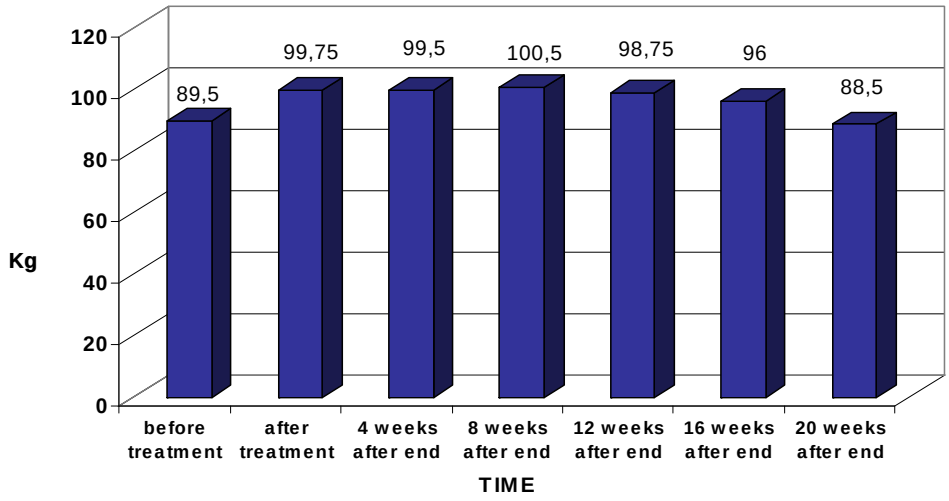

Fig. 4 – Mean pectoral muscle maximum lifting power (Kg) at any time of measurement

Mean value seems to increase immediately after the treatment and this effect seems to last for 16 weeks; afterwords, it seems to disappear and previous condition is restored. This trend is shown in Fig. 5, where mean pectoral muscle maximum lifting power percentage variation is reported.

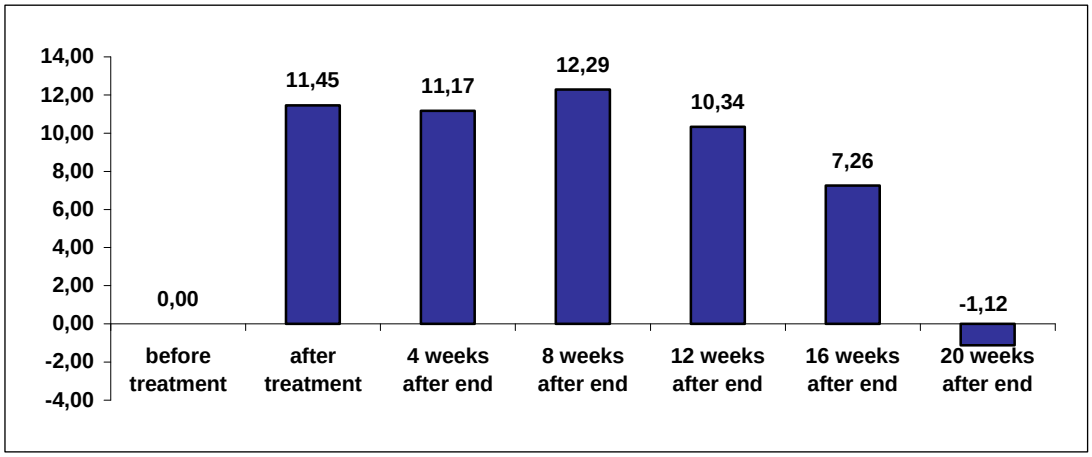

Fig. 5 – Mean pectoral muscle maximum lifting power percentage variation at any time of measurement

Very similar results were obtained in all the other tests that were performed (See Figg. 6-9).

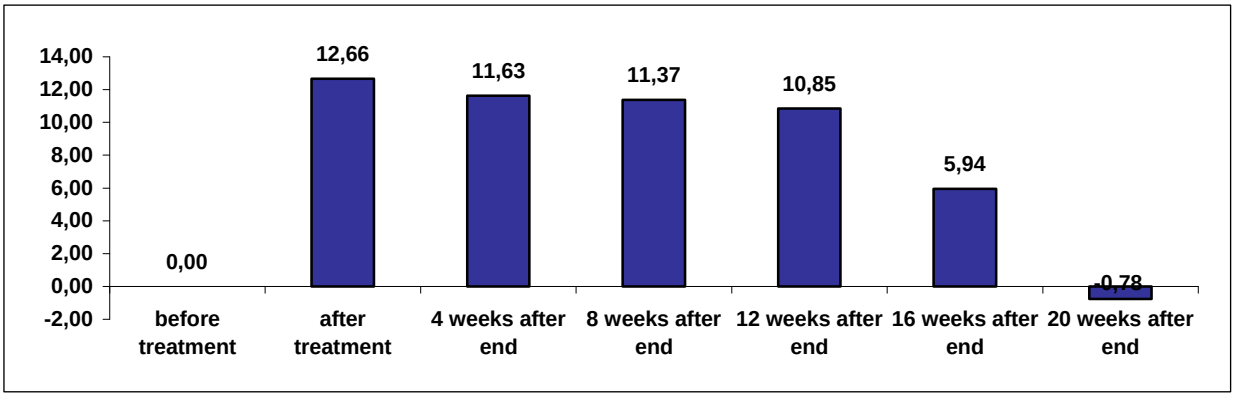

Fig. 6 – Weight lifting from the floor: mean percentage variation at any time of measurement

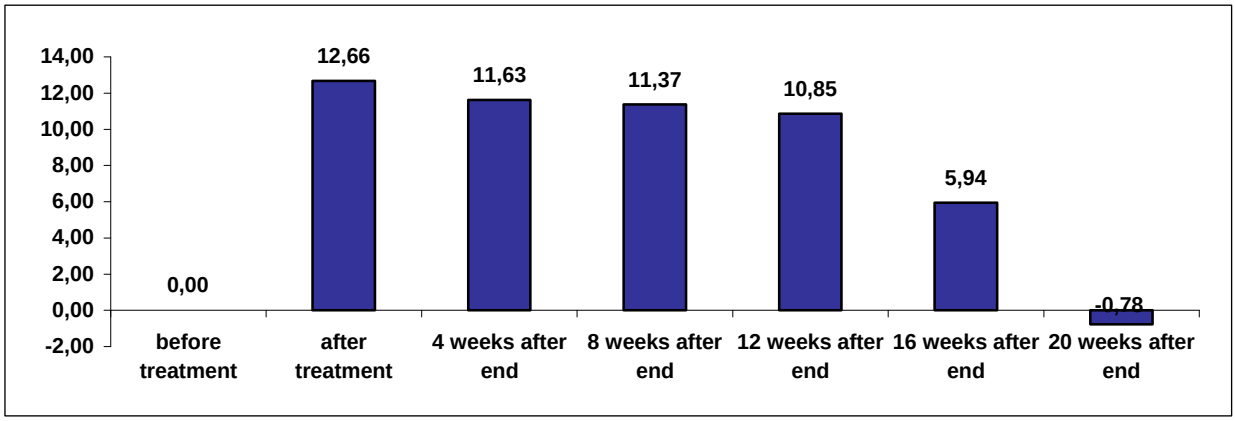

Fig. 7 – Squat: mean percentage variation at any time of measurement

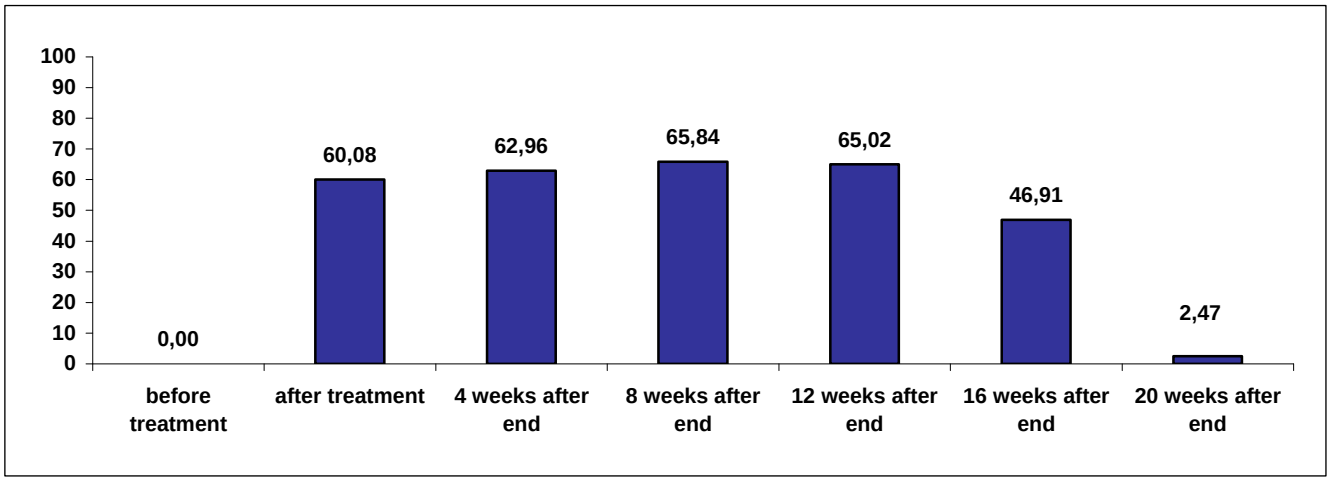

Fig. 8 – Number of swimming pool lanes: mean percentage variation at any time of measurement

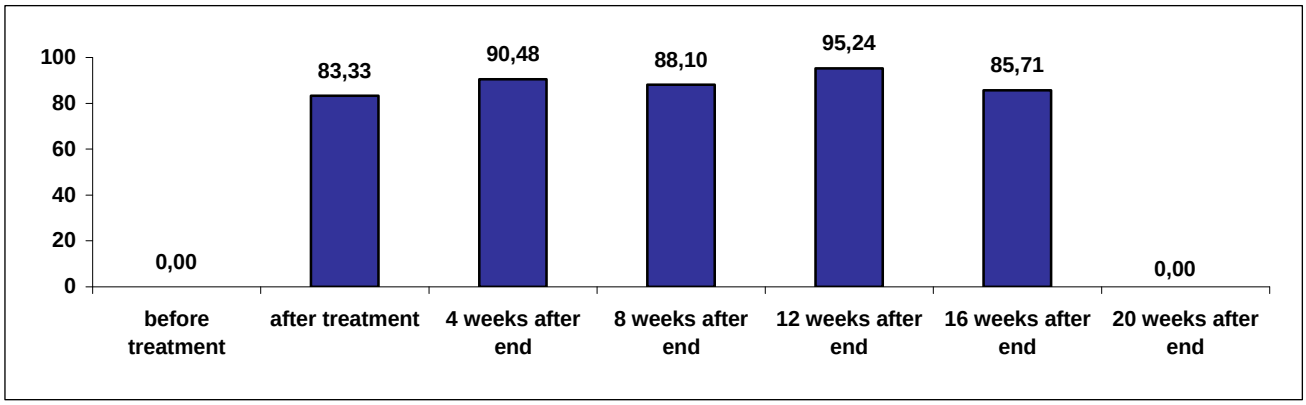

Fig. 9- Cord Jumping time: mean percentage variation at any time of measurement

Discussion

In our study, intravenous laser treatment seemed to be effective in sports medicine, even though we have to highlight that the number of cases was very small. Furthermore, there is big lack of data from the literature on this topic and further studies are needed in this field.

In all the athletes in the study, the muscolar enpowerment appeared to last for 16 weeks after the end of the treatment. Despite this datum have to be confirmed in bigger studies, we could hypothesize that it is related to the erithrocites' mean living time: 12-15 weeks. We can imagine that, after a complete cycle of treatment, all circulating red blood cells are "activated"; since they have different "ages", they will survive for different times; but, in any case, the youngest among them will disappear from circulating blood after about 15 weeks and, after that, the therapeutic effect will be lost.

In order to verify the plausibility of our findings, we wanted to perform a deep review of the medical literature on Low Lever Laser Therapy (LLLT). The review was conducted looking for "low lever laser blood irradiation" in the Pub Med Library. Only articles related to the topic of sports medicine were considered.

First of all, we could mention a polish study (1), showing higher exercise capacity, longer exercise time and longer distance of 6 minutes walk test, in 39 coronary artery disease patients, treated with LLLT on the chest area.

In a second study (2), isolated rat tibial anterior muscle was fatigued with electric current until initial strenght was lowered to 50%. Then, the rats were divided into two groups: LLLT treated group and a control group. Laser irradiated group had significantly longer time to reach 50% reduction of strength, significantly higher peak force and significantly lower creatine kinase blood levels (muscle damage index).

So, we can state that the outcomes observed in our study could be considered plausible, if compared to other studies showing biological properties of LLLT.

But the way these effects are achieved still remains unclear.

Many studies show various biological effects of laser irradiation, related to our topic.

A very important effect is the blood flow increasing. A Japanese research group (3), performed LLLT on common carotid artery area: blood flow volume in central retinal artery and ophtalmic artery increased.

A similar experiment was carried out by Makihara et al (4): LLLT on right temporomandibular joint area yield expansion of blood vessels and increase in blood flow volume in superficial temporal artery; surprisingly, this effect was observed bilaterally.

Wasik et al (5), observed PO_2 and SaO_2 increasing, after whole blood sample irradiation with 632 nm laser.

Other important referred effects are erithrocites' deformability increasing (6-8) and microcirculation increasing (9-11).

But which are the possible molecular mechanisms, explaining the above cited effects?

Mittermayr et al (12) showed that blue laser releases Nitric Oxide (NO) from Haemoglobin (Hb). NO-Hb is a form of met-Hb, with low O_2 linking power. So, free NO released from Hb is a powerful molecule producing vasodilatation and perfusion enhancement; at the same time, Hb O_2 linking power is increased.

Besides, irradiation of monocytes leads to increased NO levels from a preformed store, without activation of NO synthase and releasing of endothelial NO (13).

In a study performed by Simonian et al (14), isolated erithrocyte membrane was irradiated and Cit b 558 III activity was measured; Cit b 558 III is a membrane enzyme that restores met-Hb (H^+-Hb, CO_2-Hb, DPG-Hb) to normal Hb, with higher O_2 linking power. Cit b 558 III activity was enhanced after laser irradiation.

In conclusion, the data from our literature review seem to confirm the plausibility of our results, even though obtained from a very small study population. We hope that our preliminary data on intravenous laser therapy and sports medicine will contribute to focus the attention of many researchers on this interesting topic, so that deeper scientific knowledge could be achieved. Expecially for the last question that still is without an answer: why the effects of blood irradiation are systemic and not only local?

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