

# **Low Level Laser Therapy in the Treatment of Arteriosclerosis of the Lower Limbs.**

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## **Abstract**

Twenty patients with arteriosclerosis in the lower limbs were treated by low level laser therapy with lumbar paravertebral application a 20mW continuous wave He-Ne laser(632nm) and simultaneously a 250mW continuous diode laser (830 nm) was applied transcutaneously to the lumbar region by the scanner for 30 minutes 6 days per week for 2 months. The mean value of percentage of success was 87.2%. The results of the study indicate that low level laser therapy can influence beneficially arteriosclerosis in the lower limbs which is generally difficult to treat.

## **Introduction**

Arteriosclerosis is a chronic obliterative disease affecting the lower portion of the aorta, its main branches and the arteries supplying the extremities. The condition occurs predominantly in patients between the ages of 45 and 70 years. It is present much more frequently in males than in females. It may be caused by an error in the metabolism of lipids (Oliver, 1955). Buck (1959) believed that the abnormal vascularization of the arterial wall has also been proposed as a significant factor in the development of the disease. Also, the Question of heredity as a factor in the pathogenesis of the disease must be raised (McKusick, 1958). The patient complains of pain in the extremities typical of intermittent claudication and difficulty in walking, finally rest pain is experienced particularly at night, characterized by a sensation of coldness or burning, hyperesthesia and tingling (Abramson, 1974). The purpose of the study was to evaluate the efficacy of low power laser in the treatment of arteriosclerosis. Materials and methods Twenty patients with arteriosclerosis of the lower limbs from the out-patient clinic of the General medicine Department of both Tanta University Hospital and Alhikmah Hospital, Mansoura were included in the study. The male to female ratio was 4:1. The ages ranged from 45 to 69 years. The duration of symptoms ranged from one to 8 months (table 1). The patients were experiencing pain in both calf muscles after walking distances (claudication distance) ranging from 200 to 500 meters. Three patients experienced rest pain at night. Clinical examinations revealed palpable walls of superficial arteries, particularly the dorsalis pedis. In the study, the claudication distance was determined for every patient in meters prior to treatment. Control normal individuals within the patients' age group walked an average of 1500 meters without experiencing calf pain.

## **Results**

Pain was relieved in 16 patients who received 3 to 7 courses of treatment. Eight patients were able to walk 1500 meters without experiencing any pain in the calf muscles, hence their rate of success was 100%. The remaining patients showed improvement from 73% to 95 (table 2). Three patients discontinued treatment for reasons not related to the treatment. One patient, age 69, with 4 months duration and claudication distance of 240 meters showed no improvement after receiving 7 courses of treatment. The mean rate of success was 87.2%.

## **Discussion**

It was not easy to discuss the treatment of arteriosclerosis and only in the last 20 years have advancements been made. Although physical therapy is only part of the total management of arteriosclerosis of the lower limbs, it could play an important role in the management. No references were found in literature concentrating the use of low level laser therapy in the management of arteriosclerosis. This work has shown that low level laser therapy is capable of increasing the circulation in muscles and, with prolonged treatment, a considerable significant improvement in circulation can be achieved in cases of arteriosclerosis. Low level laser therapy not only influences the superficial circulation but also deep circulation. The mechanism of this action is probably due to the sympathetic effect, but it could also be used on the action of normal skin excitation. It can be assumed that apart from the increase in the pain threshold (Nikolova, 1968) and muscular excitation threshold, there is also an increase in the threshold for sympathetic stimulation (Pabst, 1960). By this paravertebral application, we must concede more importance to the sympathetic action, than to the direct action on the vasometer assumed by some authors (Monode, 1951; Zinn, 1956). The results obtained in the treatment of arteriosclerosis by means of low level laser therapy are certainly based on a number of different effects. First, there is sympathetic action. Also, the analgesic action of this type of current deserves special attention, since it is the cause of the subjective improvement which frequently precedes the objective improvement in cases of severe arteriosclerosis when pain is felt while resting. Also, rest pain did not mean the presence of irreversible pathologic change as the three patients with rest pain showed a good degree of improvement. The patient who showed no improvement after 7 courses of treatment may have an irreversible pathologic change and, this age of 69 years may have also contributed to the failure of treatment.

## **Conclusion**

Low level laser therapy may be considered in the treatment of peripheral arteriosclerosis.

**Table 1 – Clinical data and claudication distance**

<b>No</b>	<b>age</b>	<b>sex</b>	<b>Duration of pain in months</b>	<b>Claudication distance in meters</b>
1.	45	Male	7	250
2.	50	Male	6	300
3.	49	Male	4	Rest pain
4.	55	Female	3	360
5.	54	Male	4	380
6.	60	Male	6	200
7.	58	Male	8	320
8.	69	Male	4	240
9.	63	Male	3	Rest pain
10.	60	Male	4	350
11.	62	Male	3	380
12.	59	Male	4	400
13.	58	Female	5	450
14.	56	Female	6	500

15.	60	Male	7	300
16.	55	Male	2	250
17.	54	Male	1	Rest pain
18.	60	Female	3	350
19.	64	Male	2	300
20.	58	Male	5	260

**Table 2 – Claudication distance in metres before treatment and the distance walked without experiencing pain after treatment.**

No	Distance before treatment	Distance after treatment	Improvement
1.	250	1300	84%
2.	300	1450	85.8%
3.	Rest pain	1100	73.3%
4.	360	1500	100%
5.	380	1500	100%
6.	200	Discontinued	–
7.	320	1350	87.2%
8.	240	No improvement	0%
9.	Rest pain	1200	80%

10.	350	Discontinued	–
11.	380	1500	100%
12.	400	1500	100%
13.	450	1500	100%
14.	500	1500	100%
15.	300	1500	100%
16.	250	1350	88%
17.	Rest pain	1250	83.3%
18.	350	1500	100%
19.	300	1400	91.6%
20.	260	Discontinued	–

<http://www.healinglightseminars.com/laser-research-library/atherosclerosis/>

## **Low-intensive laser irradiation in combined treatment of lower limbs atherosclerotic lesions**

[Article in Russian]

Lipatova IO, Arslanova VM, Kriuchkov VI, Markov AN, Sakharov AB.

Seventy-one subjects entered this study. The control group consisted of 12 healthy subjects, the comparative group included 15 patients who received standard therapy of vascular diseases but without physiotherapy. The study group consisted of 44 patients whose treatment was supplemented with laser irradiation. Angiography, ultrasonic dopplerography, laser flowmetry, oxygenometry were applied for control of treatment

efficacy. Regional ischemia was evaluated with detection of pO<sub>2</sub> of foot. LT increased oxygenation of foot soft tissues in patients with low primary pO<sub>2</sub> and decreased in ones with higher. As a result the number of patients with low pO<sub>2</sub> (0 < pO<sub>2</sub> < 20) decreased from 13.7 to 4.5%, with middle pO<sub>2</sub> (20 < pO<sub>2</sub> < 40) increased from 27.3 to 50.0%, with high pO<sub>2</sub> (pO<sub>2</sub> = 40) decreased from 59.0 to 45.5%. Redistribution in favor of 20 < pO<sub>2</sub> < 40 is regarded as normalizing effect of LT. It is concluded that LT increases oxygenation of foot soft tissues in patients with low primary pO<sub>2</sub> and decreased in ones with higher.

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Lik Sprava. 2002;(8):98-102.

## **Low intensity laser radiation in complex therapy of patients with vascular obliterating atherosclerosis of low extremities**

[Article in Russian]

Klimenko IT, Shuvalova IN.

It is shown that laser therapy used in a multiple-modality treatment of patients with obliterating atherosclerosis of vessels of the interior limbs presenting with stage I-III ischemia permits achieving a substantial clinical effect manifested subjectively by fewer complaints or disappearance thereof in a proportion of patients, which fact is corroborated by objective findings such as increase in peripheral, volumetric blood flow and lower degree, in some patients, of ischemia of the extremities, improvement in processes of microcirculation and hemocoagulation. The use of laser radiation and pneumocompression combined in treatment of patients with chronic arterial insufficiency of the lower extremities of atherosclerotic genesis has been shown to have a more marked and appreciable effect. The studies made broaden our possibilities of conservative non-medicamentous treatment of obliterating atherosclerosis of vessels of the lower extremities.

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Vopr Kurortol Fizioter Lech Fiz Kult. 1998 Jul-Aug;(4):31-6.

## **Low intensity laser irradiation in therapy of elderly patients with occlusive artery disease**

[Article in Russian]

Korkushko AO, Chupryna GN.

Shown in the paper is a novel complex approach to the treatment of occlusion affections of arteries by He-Ne and infrared laseropuncture. As many as 80 patients having a history of the above health problem 5 years in duration were kept under medical

supervision. Patient age ranged between 50 to 78 years. Laserpuncture was carried out with the aid of the infrared laser stimulator [symbol: see text]-001 (wavelength 0.89 mm with continuous-wave pulse operation, pulse power 8 W) and 111 He-Ne laser (wavelength 0.63 mm, power density 5 mW/cm<sup>2</sup>, spot diameter 25 mm). 88.2 percent of patients derived apparent therapeutic benefit, 11.8 percent demonstrating a satisfactory clinical effect.

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Sov Med. 1990;(3):21-3.

## **Intravenous laser irradiation of the blood in occlusive vascular disease of the extremities**

[Article in Russian]

Shval'b PG<>, Zakharchenko Ala<>, Sigaev AA<>, Kataev MI<>.

The authors analyze the results of clinical application of intravenous He-Ne laser irradiation of the blood in patients with obliterating diseases of the limb vessels. Starting from 1984, this method was employed in the treatment of 133 patients, of these 102 ones with atherosclerosis obliterans of the lower limb vessels, 17 with endarteritis obliterans, and 14 with Raynaud's syndrome. Intravenous laser therapy proved to be the most effective in atherosclerotic involvement of the vessels, when positive result was achieved in 77.5 percent of patients. The length of remission was up to 6 months. the method of treatment is described.

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Circulation. 1992 Feb;85(2):756-68.

## **Can Laser Lower Blood Pressure? – YES!**

J of Chiro.Med, 2008 Dec;7(4):134  
<http://www.sciencedaily.com/releases/2011/08/110811083820.htm>

This study reports on the effects of laser acupuncture on blood pressure, body weight, and heart rate variability by stimulating acupuncture points and meridians. Because it was done on humans and is a randomized trial, it is especially interesting. Forty-five patients were recruited in the study. The acupuncture points used in this study were LI 4 and LI 11 for body weight and blood pressure. The treatment groups received 16 J of laser energy output for a total treatment time of 8 minutes (4 minutes for each of the 2 points). After using the laser treatment for 90 days (at least 12 treatments per subject), both the systolic and diastolic blood pressures decreased significantly ( $P < .01$ ). The subject's body weight was reduced in the active treatment group, but the weight reduction did not reach a level of statistical significance. It was concluded that low-level laser treatment of acupoints resulted in lower blood pressure by stimulating the LI 11 and LI 4.

## Can Laser Prevent Abdominal Aneurysm?

One area of laser therapy that is intriguing, but with very little research, concerns the use of laser to treat areas outside the musculoskeletal system. It is interesting to see aneurysm being studied (Cardiovasc Res. 2009 May 14) in this case because there are a number of studies showing improved cardiac and circulatory function with laser therapy.

In this study the researchers used a 780 nm laser on mice and tested the aorta with High frequency ultrasonography. At 4 weeks, 7 of 15 non-irradiated mice, but none of the 13 low level laser treated mice, had their aneurysms worsen. These in vivo studies, together with previous in vitro studies, appear to provide strong evidence in support of a role for low level laser in the attenuation of aneurysm progression. Further studies in large animals would appear to be the next step toward testing the applicability of this technology with humans. However, the fact that LLLT helped cure an aneurysm is an exciting discovery.

## Specific Effects of Laserpuncture on the Cerebral Circulation

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Paper received 10 May 1999; accepted after revision 23 August 1999

Akupunktura is a form of traditional Chinese medicine that has developed over thousands of years. We studied the effects of laser puncture, needle acupuncture, and light stimulation on cerebral blood flow in 15 healthy volunteers (mean age  $25.0 \pm 1.9$  years, 5 female, 10 male) with non-invasive transcranial Doppler sonography. In addition 40-Hz stimulus-induced brain oscillations, heart rate, blood pressure, peripheral and cerebral oxygen saturation, and the bispectral index of the EEG were recorded.

Stimulation with light significantly increased blood flow velocity in the posterior cerebral artery ( $p < 0.01$ , ANOVA). Similar but less pronounced effects were seen after needle acupuncture ( $p < 0.05$ , ANOVA) and laserpuncture (n.s.) of vision-related acupuncture points. Furthermore both, laserpuncture and needle acupuncture, led to a significant increase in the amplitudes of 40-Hz cerebral oscillations. Stimulation of vision-related acupuncture points with laser light or needle acupuncture elicits specific effects in specific areas of the brain. The results indicate that the brain plays a key intermediate role in acupuncture. However, brain activity of itself does not explain anything about the healing power of acupuncture.

## Low-level Laser Therapy Accelerates Collateral Circulation and Enhances Microcirculation

Ihsan FR. Department of Anatomy, AL-Kindy College of Medicine, University of Baghdad, Iraq. PMID: 15954817 (PubMed – indexed for MEDLINE)

**OBJECTIVE:** To evaluate the efficacy of low-level laser therapy (LLLT) on collateral circulation and microcirculation if a blood vessel is occluded. **BACKGROUND DATA:** Investigators have attempted prostaglandin and ultrasound therapy to promote improvements in the vascular bed of deprived tissue after an injury, which may lead to occlusion of the blood vessels.

**MATERIALS AND METHODS:** Thirty-four adult rabbits were used in this study, two of them considered 0-h reading group, while the rest were divided into two equal groups, with 16 rabbits each: control and those treated with LLLT. Each rabbit underwent two surgical operations; the medial aspect of each thigh was slit, the skin incised and the femoral artery exposed and ligated. The site of the operation in the treated group was irradiated directly following the operation and for 3 d after, one session daily for 10 min/session. The laser system used was a gallium-aluminum-arsenide (Ga-Al-As) diode laser with a wavelength of 904 nm and power of 10 mW. Blood samples collected from the femoral artery above the site



of the ligation were sent for examination with high-performance liquid chromatography (HPLC) to determine the levels of adenosine, growth hormone (GH) and fibroblast growth factor (FGF). Tissue specimens collected from the site of the operation, consisting of the artery and its surrounding muscle fibers, were sent for histopathological examination to determine the fiber/capillary (F/C) ratio and capillary diameter. Blood samples and tissue specimens were collected at 4, 8, 12, 16, 20, 24, 48 and 72 h postoperatively from the animals of both groups, control and treated.

**RESULTS:** Rapid increases in the level of adenosine, GH, and FGF occurred. The F/C ratio and capillary diameter peaked at 12-16 h; their levels declined gradually, reaching normal values 72 h after irradiation in the treated group. Numerous collateral blood vessels proliferated the area, with marked increases in the diameters of the original blood vessels.

**CONCLUSIONS:** The results indicated that LLLT accelerated collateral circulation and enhanced microcirculation and seemed to be unique in the normalization of the functional features of the injured area, which could lead to occlusion of the regional blood vessels.

## **Impact of Low Level Laser Irradiation on Infarct Size in the Rat Following Myocardial Infarction.**

Ad N, Oron U.  
Int J Cardiol. 2001; 80:109-116

The effect of LLLI on the development of acute myocardial infarction (MI) was investigated following chronic ligation of the left anterior descending (LAD) coronary artery in laboratory rats. The hearts of 22 rats were laser irradiated (LI) using a diode laser (804 nm, 38 mW power output) through the intercostal muscles in the chest following MI and on day 3 post MI. In the control non laser irradiated (NLI) group (19 rats) MI was induced experimentally and laser irradiation was not applied. All rats were sacrificed 21 days post MI. Size, thickness and relative circumferential length of the infarct, as well as other parameters, were determined from histological sections stained with Masson's trichrome and hearts stained with triphenyl tetrazolium chloride (TTC) using histomorphometric methods. The infarct size (expressed as percent of total left ventricle area) of the LI rats was  $10.1 \pm 5.8$ , which was significantly lower (65%;  $P < 0.01$ ) than the infarct size of NLI rats which was  $28.7 \pm 9.6$ . Correlatively, the ratio of circumferential length of the infarcted area was significantly lower (2-fold;  $P < 0.01$ ) in the LI rats as compared to the NLI rats. LLLI of the infarcted area in the myocardium of experimentally induced MI rats, at the correct energy, duration and timing, markedly reduces the loss of myocardial tissue. This phenomenon may have an important beneficial effect on patients after acute MI or ischemic heart disease.

## **Laser Laser Reduces Heart Attack**

Photomed Laser Surg. 2009 Apr; 27(2):227-33

One of the hot areas in medicine is the use of stem, satellite and mesenchymal cells to rehabilitate tissues damaged through disease and trauma. In this study, the researchers implanted laser-irradiated mesenchymal stem cells into the hearts of rats damaged by heart attack.

It was demonstrated that low-level laser therapy (LLLT) at 810 nm wavelength rehabilitated the area receiving those cells. In the area that received mesenchymal cells without LLLT, there was no improvement in the heart tissue. In fact, the LLLT treated hearts showed a 53% decrease in infarct size compared to hearts that were implanted with non-laser-treated cells! Also the hearts implanted with laser-treated cells demonstrated a 5- and 6-fold increase in cell density.

This is one more example of how LLLT can significantly increase survival and/or proliferation of healthy tissue when there has been trauma or disease.

## **Low Level Laser Therapy for Stroke**

Curr Cardiol Rep. 2010 Jan;12(1):29-33.

Although there have been improvements in the physical therapy of stroke, TPA (Tissue Plasminogen Activator) is the only proven therapy. However, this is a very expensive treatment and cannot be used universally.

Recently, low level laser therapy (LLLT) has been applied to acute ischemic stroke patients. This technique uses LLLT applied to the scalp within 24 hours of the stroke. A study performed at University of California, San Diego Medical Center revealed a significantly improved success rate in patients treated with laser therapy. Further phase 3 testing is planned and may create a new paradigm for the treatment of acute ischemic stroke. The authors postulate that the success was due to increased ATP production.

These types of studies demonstrate the infinite variety of uses for LLLT in medicine and natural therapy. LLLT may turn out to be the ultimate “complementary medicine” tool since it can easily and effectively bridge medicine and natural therapy.

## **Low Level Laser Therapy in Chronic Autoimmune Thyroiditis**

Lasers Surg Med. 2010 Aug;42(6):589-96

Chronic autoimmune thyroiditis (CAT) is the most common cause of hypothyroidism. There is currently no therapy that is capable of regenerating CAT damaged thyroid tissue. The objective of this study was to gauge the value of applying low-level laser therapy (LLLT) in CAT.

The laser that was used had a wavelength of 830 nm, very similar to the LZR7 laser. They noted that “all patients [had] reduced medication dosage needs”, including 47% who did not require any medication at all! They concluded that LLLT promoted the improvement of thyroid function since the patients experienced a decreased need for medication and an improvement in lab values.