



Innovation is built on results.





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La Laserterapia MLS® si basa sul Multiwave Locked System, una tecnologia che genera un impulso brevettato ottenuto dalla combinazione e sincronizzazione di sorgenti continue e pulsate con differenti lunghezze d'onda. L'impulso MLS® abbina l'emissione continua di un diodo a 808 nm con l'emissione pulsata di un diodo a 905 nm in grado di sfruttare a pieno i vantaggi dell'alta potenza di picco senza il rischio di indurre effetti termici dannosi. La combinazione e la sincronizzazione potenziano in modo sinergico gli effetti terapeutici di ciascuna delle lunghezze d'onda ottimizzando l'effetto antinfiammatorio, antiedemigeno, analgesico e biostimolante.

L'innovazione è costruita sui risultati: è questo il titolo che abbiamo voluto dare al nostro lavoro. E i risultati sono costruiti sulla condivisione. Crediamo da sempre in questa parola, importantissima: condivisione. Per questo in ASAlaser lavoriamo ogni giorno moltissimo con il preciso obiettivo di creare una rete dinamica di relazioni composta da Ricercatori e Medici che credono, come noi, nell'importanza di condividere obiettivi e risultati scientifici. Condividere è il presupposto di tutto quello che facciamo, è il senso stesso della ricerca, è una parola che significa futuro, miglioramento, crescita in termini di conoscenza e di esperienza.

Questo libro rappresenta dunque una raccolta di rilevanti studi che dimostrano concretamente ciò che scriviamo in comunicazione e spieghiamo a voce ai nostri clienti. Siamo orgogliosi di averlo pensato e pubblicato: non tanto come uno strumento che parla di noi, bensì come un contenitore di scienza e risultati ASAlaser. Da condividere con Voi, per il vostro e il nostro lavoro.

Innovation is built on results: this is the title we gave our book. And results are built on sharing. We have always believed in sharing, which we consider to be an extremely important word. This is why we at ASAlaser work very hard every day to build a dynamic network of relations with Researchers and Doctors who, just like us, believe in the importance of sharing objectives and scientific results. Sharing is the prerequisite for everything we do, it is the true meaning of research, it is a word that means future, improvement, growth in terms of knowledge and experience.

This book therefore represents a collection of pertinent studies that solidly demonstrate what we have written, and what we explain vocally to our clients. We are proud to have thought of and published it: not just as an instrument that speaks about us, but as a recipient filled with ASAlaser science and results. We want to share it with you, for your work and ours.

Roberto Marchesini Managing Director of ASAlaser

MLS® Laser Therapy is based on the Multiwave Locked System, a patented technology that generates a pulse by combining and synchronizing continuous and pulsed emissions with different wavelengths. The MLS® pulse combines the continuous emission of an 808 nm diode with the pulsed emission of a 905 nm diode able to make full use of the advantages of high peak power without the risk of inducing harmful thermal effects. Combination and synchronization enhance the therapeutic effects of each wavelength in a synergistic manner thus optimizing the anti-inflammatory, anti-edema, analgesic and biostimulation effect.

Dal 1983 ad oggi ASAlaser è diventata punto di riferimento internazionale nella Laserterapia e nella Magnetoterapia nei campi della fisioterapia e della riabilitazione, della gestione del dolore (pain management) muscolare e articolare in ambito medico umano e anche veterinario. I traguardi che abbiamo raggiunto sono costruiti sui valori che rappresentano la sintesi del nostro progetto imprenditoriale: specializzazione e ricerca nello sviluppo di soluzioni terapeutiche basate su sorgenti laser e campi magnetici, gestione integrata del ciclo produttivo delle apparecchiature, formazione, internazionalizzazione. In particolare è sulla ricerca che ci vogliamo soffermare, parte integrante dell'azienda e nucleo della nostra identità: una ricerca fondata sulla condivisione del sapere con i professionisti della salute umana e veterinaria ed intesa non solo come strumento per convalidare la qualità delle apparecchiature, bensì come necessaria premessa alla loro nascita. Grazie alla ricerca, che ha saputo unire i confini tra teoria e applicazione, abbiamo superato i limiti della Laserterapia tradizionale, definendo il nuovo traguardo della Laserterapia MLS®.

Il nostro lavoro è fondato su una convinzione precisa: i grandi risultati sono più importanti dei grandi numeri. E noi siamo orgogliosi di migliorare la qualità della vita delle persone, grazie alle nostre apparecchiature medicali e soluzioni terapeutiche, oggi diffuse in oltre 50 Paesi in Cliniche e Studi sia pubblici che privati.

From 1983 to today ASAlaser has become an international point of reference in Laser Therapy and Magneto Therapy in the fields of physiotherapy and rehabilitation, as well as in muscle and joint pain management, for the treatment of both humans and animal species. The targets we have achieved so far are built upon values that embody our business project: specialization and research in the development of therapeutic solutions based on laser sources and magnetic fields, integrated management of the equipment manufacturing cycle, training and internationalization. In particular, we want to dwell on research, since it is an integral part of our company and the core of our identity: research is based on the sharing of know-how with veterinary and human healthcare professionals, and it is not solely regarded as a means to validate equipment quality but also as a precondition necessary for its development. Through research, which has been able to join the borders between theory and application, we overcame the limitations of traditional laser therapy, establishing the new goal of MLS® Laser Therapy.

Our work is based on a firm belief: great results are more important than great numbers. And we are proud to improve people's quality of life through our medical equipment and therapeutic solutions that nowadays are widespread in over 50 countries in public and private practices and clinics.

Lucio Zaghetto President of ASAlaser



Questo libro presenta una raccolta di abstracts di pubblicazioni scientifiche sulla sicurezza e l'efficacia della Laserterapia MLS® in vari campi di applicazione. Queste pubblicazioni riportano i risultati di una ricerca, coordinata dalla Divisione Ricerca di ASA, che è stata svolta in numerosi centri clinici e di ricerca, sia pubblici che privati.

Oltre a studi clinici, sono presenti anche alcuni studi sui meccanismi molecolari e cellulari alla base degli effetti della Laserterapia MLS®. Questi studi sono stati effettuati presso il laboratorio congiunto ASAcampus, laboratorio dedicato allo studio del ruolo di fattori fisici in campo biologico e medico, nato da un accordo tra il Dipartimento di Scienze Biomediche Sperimentali e Cliniche dell'Università di Firenze e la Divisione Ricerca di ASA srl.

MLS® (Multiwave Locked System) è un laser di classe IV costituito da due diodi sincronizzati. Il primo ha una modalità di emissione pulsata con lunghezza d'onda $\lambda=905$ nm, il secondo ha lunghezza d'onda $\lambda=808$ nm e doppia modalità di emissione: continua o pulsata. I due fasci laser lavorano contemporaneamente, in modo sincrono e gli assi di propagazione sono coincidenti. Il laser MLS® è progettato per sfruttare contemporaneamente gli effetti indotti da diverse lunghezze d'onda e modalità di emissione. Entrambe le lunghezze d'onda (808 nm e 905 nm) rientrano nella cosiddetta "finestra terapeutica", che è l'intervallo di lunghezze d'onda (da 600 nm a 1200 nm) in cui l'assorbimento da parte dei cromofori endogeni è basso e, di conseguenza, la propagazione della radiazione nei tessuti è relativamente elevata.

Dal 2004 la Laserterapia MLS® viene utilizzata in numerosi centri medici pubblici e privati situati in vari paesi del mondo, dimostrando la sua efficacia nel campo della medicina sportiva, della fisioterapia e della riabilitazione. Recentemente, la sua applicazione è stata estesa alla medicina veterinaria. Durante questo lungo periodo, la ricerca sulla Laserterapia MLS® non si è mai fermata. Grazie a studi clinici, la Laserterapia MLS® è stata sottoposta a continue validazioni per attestarne la sicurezza e l'efficacia nel trattamento di numerose e diverse patologie. Studi in vitro su colture cellulari ed in vivo su modelli animali hanno permesso di comprendere alcuni dei meccanismi

molecolari e cellulari che sono alla base degli effetti sistemici e terapeutici della Laserterapia MLS®.

Sulla base dei risultati ottenuti da uno studio preliminare su topi albini e neri (diversi per concentrazione di melanosomi a livello epidermico), è stato effettuato uno studio di modellazione con lo scopo di analizzare, nella cute e nei tessuti più profondi, gli effetti termici in dipendenza dalle condizioni di irraggiamento e dalla pigmentazione cutanea. L'analisi predittiva ottenuta può essere utilizzata come un efficace strumento per elaborare linee guida per la Laserterapia MLS®, nonché per la progettazione di protocolli clinici personalizzati, considerando il fenotipo del paziente. I risultati mostrano che con un corretto utilizzo della sorgente laser MLS® è possibile ottenere un aumento di temperatura controllata dei tessuti, che rimane al di sotto della soglia di danno¹.

Studi di proteomica condotti su cellule muscolari hanno dimostrato che la Laserterapia MLS® induce un aumento della proteina anti-infiammatoria NLRP 10, la quale inibisce la produzione delle interleuchine pro-infiammatorie IL-1 β e IL-18, riducendo l'infiammazione². Pertanto, la Laserterapia MLS® può essere applicata nel trattamento di molte patologie dove è importante ridurre la componente infiammatoria. La diminuzione dell'infiammazione porta ad una normalizzazione della funzione vascolare, ad una riduzione dell'edema e della sintomatologia dolorosa.

Sempre mediante analisi di proteomica e tecniche di immunofluorescenza, è stato inoltre dimostrato, in colture di mioblasti, che la Laserterapia MLS® promuove un processo di differenziazione, caratterizzato da cambiamenti della morfologia cellulare e dell'architettura citoscheletrica che portano alla formazione di strutture assimilabili a miotubi. Questi e altri risultati sono descritti in dettaglio nei lavori scientifici i cui abstracts sono raccolti in questo libro.

1. Rossi F, Pini R, Romano G, Cialdai F, Fusi F, Monici M. A predictive analysis of thermal effects in pigmented skin and underlying tissues during IR laser therapy. *Energy for Health* 2014, 12: 4-10.

2. Monici M, Cialdai F, Ranaldi F, Paoli P, Boscaro F, Monetti G, Caselli A. Effect of IR laser on myoblasts: a proteomic study. *Mol Biosyst.* 2013 Jun;9(6):1147-61.

This book presents a collection of summaries of scientific papers on safety and effectiveness of MLS® Laser Therapy in different fields of application. The papers report the outcomes of research coordinated by ASA Research Division and carried out in numerous clinical and research centers, both public and private.

In addition to clinical studies, there are also studies on the molecular and cellular mechanisms underlying the effects of MLS® Laser Therapy, which have been carried out at the ASAcampus Joint Laboratory, dedicated to study the role of physical factors in biology and medicine and born by an agreement between the Department of Experimental and Clinical Biomedical Sciences, University of Florence and ASA Research Division, ASA srl.

The MLS® - Multiwave Locked System is a class IV near infrared (NIR) laser source which consists of two synchronized diodes. The first one is pulsed and emits at 905 nm wavelength, the second may operate in continuous or frequency mode with 808 nm wavelength. The two laser beams work simultaneously, synchronously and the propagation axes are coincident. The MLS® laser is designed to exploit simultaneously the effects induced by different wavelengths and emission modes. Both wavelengths (808 nm and 905 nm) fall into the so-called "therapeutic window", that is the interval of wavelengths (from 600 nm to 1200 nm) where absorption by endogenous chromophores is low and, consequently, propagation of radiation into the tissues is relatively high.

Since 2004 the MLS® Laser Therapy has been used in many public and private medical centers located in various countries around the world, proving its effectiveness in the fields of sports medicine, physiatrics and rehabilitation. Recently, its application has been extended to veterinary medicine. During this long period, research on MLS® Laser Therapy has never stopped. Through clinical trials, MLS® Laser Therapy has undergone continuous validations to attest safety and the efficacy in treating many different diseases.

In vitro and in vivo studies on cell cultures and animal models, respectively, have allowed us to understand some molecular and cellular mechanisms that underlie systemic and therapeutic effects of MLS® Laser Therapy. On the basis of a preliminary experimental study in albino and black mice (differing for epidermal melanosomes concentration), a modeling study was carried out in order to analyze the thermal effects in the skin and deeper tissues in dependence of irradiation conditions and skin pigmentation. The predictive analysis obtained may be used as an effective tool to draft guidelines for MLS® Laser Therapy as well as to design personalized clinical protocols, considering the patient's phenotype. The results show that, with a correct use of the MLS® laser source it is possible to obtain a controlled temperature increase of the tissues, which remains below the damage threshold¹.

Proteomics studies carried out on muscle cells have shown that MLS® treatment induces an increase of the anti-inflammatory protein NLRP 10, that inhibits the production of pro-inflammatory interleukins IL-1 β and IL-18, reducing inflammation².

Therefore, MLS® Laser Therapy may be applied in the treatment of many diseases in which it is useful to reduce the inflammatory component. The decrease in inflammation leads to a normalization of vascular function, reduction of edema and painful symptoms. Moreover, by proteomic analysis and immunofluorescence techniques, it has been demonstrated that MLS® Laser Therapy promotes in myoblasts a differentiation process with changes of cell morphology and cytoskeletal architecture leading to the formation of tube-like structures. These and other results are described in details in papers whose abstracts are collected in this book.

Dr. Monica Monici



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**APPLICATION OF MLS® THERAPY
ON A DISC HERNIATION WITH
RADICULOPATHY: A CASE STUDY.**

ABSTRACT

This paper presents the case of a 17 year old female who suffered from severe lumbalgia and radiculopathy into the left leg. The purpose of this clinical case was to determine the effects of NIR laser therapy on pain associated with disc herniation. The source used was a Multiwave Locked System (MLS®) MLS® Laser. The instrument consisted of two assembled laser diodes with synchronized emissions at 808 and 905 nm, respectively. The technique utilized to apply the laser radiation was the global approach using both the ultrahead and handpiece to deliver the treatment. Laser application was initially performed three times per week for the first course of treatment and decreased in frequency for the remainder of care according to the patient's reduction in subjective findings. The patient's progress was measured by the Visual Analogue Scale (VAS). A percentage improvement scale was also utilized to determine the percent improvement in pain and range of motion. The results showed steady improvement of pain relief during the seven month course of treatment. At nine months the pain was not present. The results indicate that MLS® laser therapy has beneficial effects on pain associated with disc herniation.

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**EFFECT OF HIGH POWER
DUAL WAVELENGTH NIR
LASER EMISSION IN A RAT
MODEL OF COMPRESSIVE
PAIN.**

ABSTRACT

Chronic pain condition, such as neuropathic pain, is one of the most important health problems worldwide and, due to its uncertain etiology and poor response to therapy, it represents an important challenge for medicine. Although, nowadays, there are many drugs for the treatment of chronic pain, their use is limited by the frequent side effects and, in some cases, ineffectiveness. Thus, the search for new therapeutic strategies which minimize this important problem is actually growing. Since many years, laser therapy has been used as a physical therapy for pain relief and has become increasingly popular because it is non-invasive and no side effects have been reported after treatment. However, its true effectiveness is still controversial because of the counteracting results reported in literature. In the present study we investigated the effectiveness of a high power, dual wavelength NIR laser source in producing fast analgesic effect in a rat model of neuropathic pain, induced through loose ligation of the sciatic nerve. Twelve animals were included in the study and two treatment protocols were tested, one performed daily, the other every 48 hours, with a total of 5 applications. Both protocols used were able to statistically increase the pain threshold of the ipsilateral paw (the one with loose ligation of the sciatic nerve), starting 5 min after their first applications. The anti-hyperalgesic effect of laser treatment terminated 60 min after application. It started again, showing the same anti-hypersensitivity profile, during the subsequent applications. The treatment protocol tested in this in vivo study in animal model might be applied to give the patient immediate pain relief and combined with treatments aimed to reduce inflammation, thus leading to analgesic effects that lasts over time.

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**IN VITRO STUDY ON THE SAFETY
OF NEAR INFRARED LASER THERAPY
IN ITS POTENTIAL APPLICATION
AS POSTMASTECTOMY LYMPHEDEMA
TREATMENT.**

ABSTRACT

Clinical studies demonstrated the effectiveness of laser therapy in the management of postmastectomy lymphedema, a discomforting disease that can arise after surgery/ radiotherapy and gets progressively worse and chronic. However, safety issues restrict the possibility to treat cancer patients with laser therapy, since the effects of laser radiation on cancer cell behavior are not completely known and the possibility of activating postmastectomy residual cancer cells must be considered.

This paper reports the results of an in vitro study aimed at investigating the effect of a class IV, dual-wavelength (808 nm and 905 nm), NIR laser system on the behavior of two human breast adenocarcinoma cell lines (namely, MCF7 and MDA-MB361 cell lines), using human dermal fibroblasts as normal control. Cell viability, proliferation, apoptosis, cell cycle and ability to form colonies were analyzed in order to perform a cell-based safety testing of the laser treatment in view of its potential application in the management of postmastectomy lymphedema. The results showed that, limited to the laser source, treatment conditions and experimental models used, laser radiation did not significantly affect the behavior of human breast adenocarcinoma cells, including their clonogenic efficiency. Although these results do not show any significant laser-induced modification of cancer cell behavior, further studies are needed to assess the possibility of safely applying NIR laser therapy for the management of postmastectomy lymphedema.

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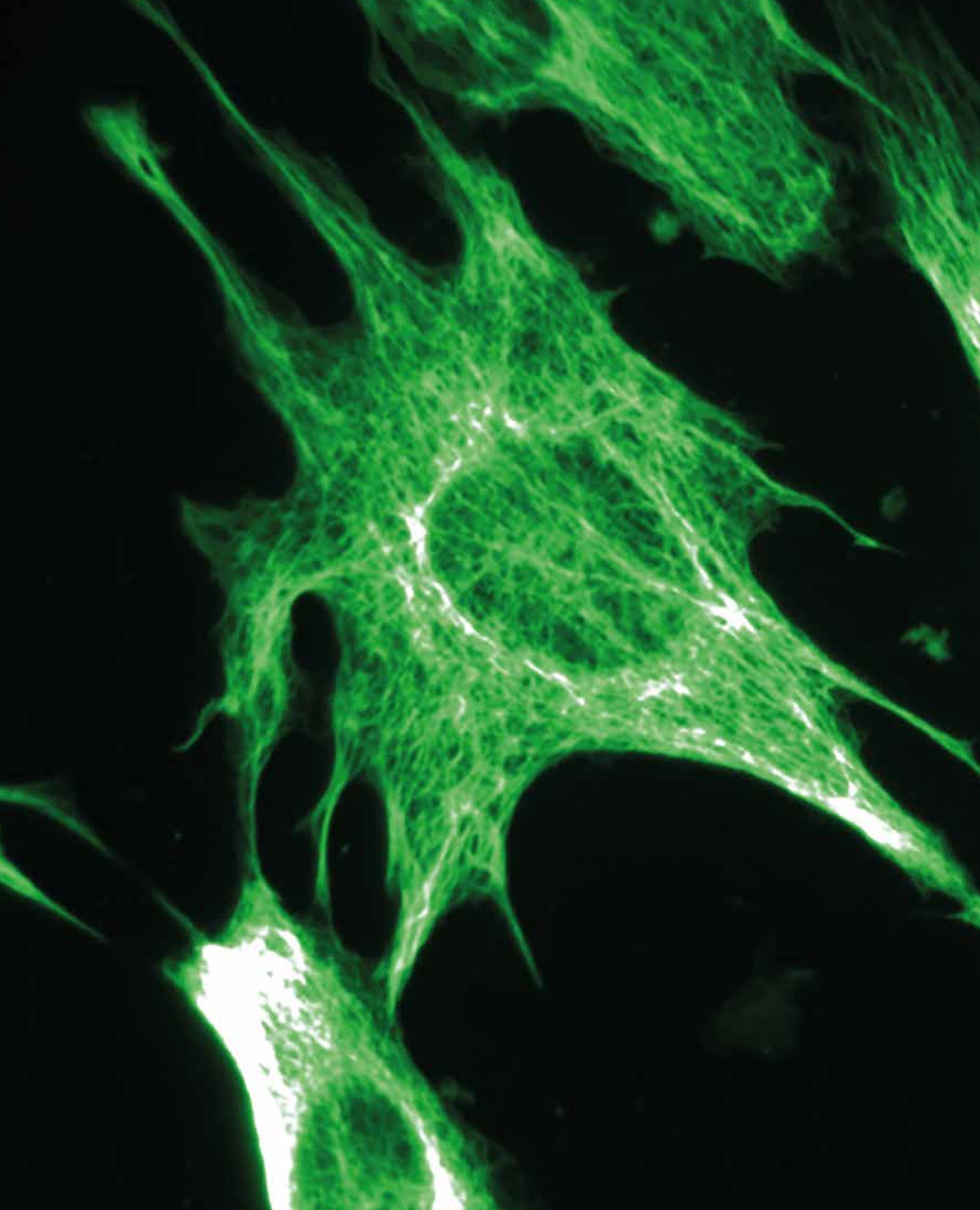
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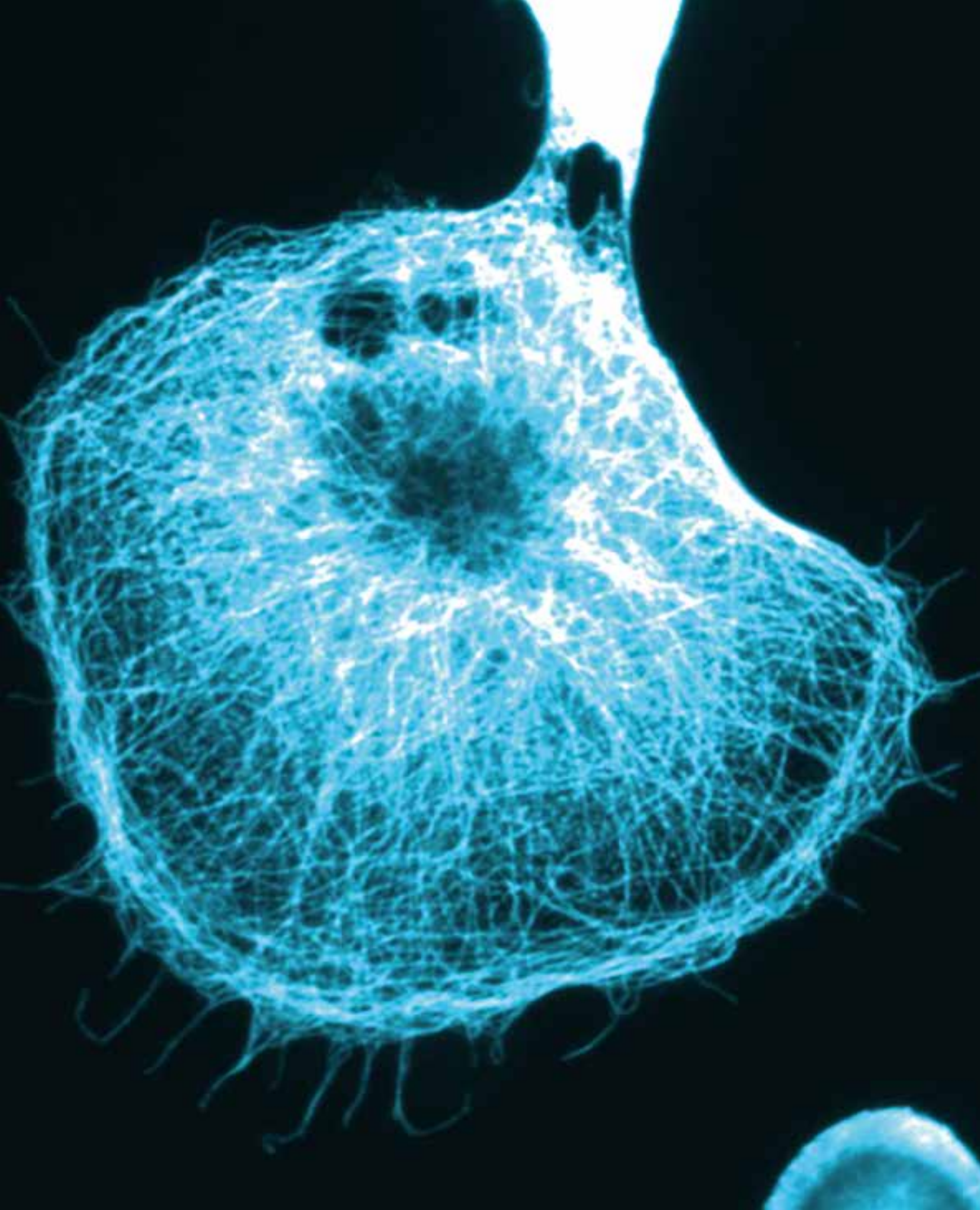
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EFFECTS OF NEAR-INFRARED LASER RADIATION ON THE SURVIVAL AND INFLAMMATORY POTENTIAL OF CANDIDA SPP. INVOLVED IN THE PATHOGENESIS OF CHEMOTHERAPY-INDUCED ORAL MUCOSITIS.

ABSTRACT

Candida spp. usually colonize ulcerative lesions of atrophic mucosa in patients with chemotherapy-induced oral mucositis inducing severe inflammation. The spread of antifungal-resistant strains strongly encouraged the search of complementary or alternative therapeutic strategies to cure inflamed mucosa. In this paper, we studied the effects of a near-infrared (NIR) laser system with dual-wavelength emission (808 nm+904 nm) on the survival and inflammatory potential of C. albicans, C. glabrata, and C. parapsilosis. Laser treatment was performed with a Multiwave Locked System laser. Survival and apoptosis of fungal strains were evaluated by colony-forming units (CFU) counting and annexin V staining. Cytokine production was evaluated by ImmunoPlex array. Laser treatment significantly affected the survival of Candida spp. by inducing apoptosis and induced a lower production of inflammatory cytokines by dendritic cells compared to untreated fungi. No differences in the survival and inflammatory potential were recorded in treated or untreated Saccharomyces cerevisiae cells, used as the control non pathogenic microorganism. Laser treatment altered the survival and inflammatory potential of pathogenic Candida spp. These data provide experimental support to the use of NIR laser radiation as a co-adjuvant of antifungal therapy in patients with oral mucositis (OM) complicated by Candida infections.

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YEAR 2015

JOURNAL

Eur J Clin Microbiol Infect Dis; 34(10): 1999-2007

EFFECT OF MLS® LASER THERAPY
WITH DIFFERENT DOSE REGIMES FOR
THE TREATMENT OF EXPERIMENTALLY
INDUCED TENDINOPATHY IN SHEEP:
PILOT STUDY.

ABSTRACT

Objective. The aim of this preliminary study was to investigate the effect of Multiwave Locked System (MLS®), a particular model of low-level laser, in the acute phase of collagenase-induced tendon lesions in six adult sheep randomly assigned to two groups.

Background data. Tendon injuries are common among human athletes and in sport horses, require a long recovery time, and have a high risk of relapse. Many traditional treatments are not able to repair the injured tendon tissue correctly. In recent years, the use of low-level laser therapy (LLLT) produced interesting results in inflammatory modulation in different musculoskeletal disorders.

Methods. Group 1 received 10 treatments of MLS® laser therapy at a fluence of 5 J/cm² on the left hindlimb. Group 2 received 10 treatments of MLS® laser therapy at a fluence of 2.5 J/cm² on the left hindlimb. In every subject in both groups, the right hindlimb was considered as the control leg.

Results. Clinical follow-up and ultrasonography examinations were performed during the postoperative period, and histological examinations were performed at day 30 after the first application of laser therapy. In particular, results from histological examinations indicate that both treatments induced a statistically significant cell number decrease, although only in the second group did the values return to normal. Moreover, the MLS® laser therapy dose of 2.5 J/cm² (group 2) caused a significant decrease of vessel area.

Conclusion. In this study, clinical and histological evaluation demonstrated that a therapeutic dose <5 J/cm² furnished an anti-inflammatory effect, and induced a decrease of fibroblasts and vessel area. Overall, our results suggest that MLS® laser therapy was effective in improving collagen fiber organization in the deep digital flexor tendon.

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YEAR 2015

JOURNAL

Photomed Laser Surg. 2015 Mar;33(3):
154-63.

TREATMENT OF CHRONIC
CRANIOFACIAL PAIN WITH MPHI
LASER AND ORTHOTIC.

ABSTRACT

Laser therapy has become an increasingly adopted method of physical medicine to help accelerate healing and reduce pain. Treatment of craniofacial pain using laser therapy has also been vastly researched. The purpose of this study was to determine whether the treatment protocol we use is efficacious in decreasing the painful symptoms of craniofacial pain immediately after treatment. 65 patients (age range 13 to 65) were treated with a dual wavelength NIR laser source. In this Multiwave Locked System (MLS) laser the two emissions at 808 nm and 905 nm, respectively, with continuous chopped and pulsed delivery, are synchronized. TM joints, masseters, trapezius muscles, and cervical area were treated. The patients were asked to state their overall pain level pre and post treatment using the Visual Analog Scale (VAS). This was then converted into a percentage for ease of documentation. A comparison of pre and post VAS scales showed a 49.9% decrease in pain after the first treatment, 25.2% decrease after the second treatment and 9.0% decrease after the third treatment. In conclusion, the protocol used in the study provided a clinically relevant decrease in craniofacial pain, and a treatment duration of 8 minutes per session could be adapted to the normal clinical setting.

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YEAR 2014

JOURNAL

Energy for Health; 13: 4-8

**LASERPUNCTURE WITH MLS®
(MULTIWAVE LOCKED SYSTEM)
SYSTEM MPH: SAFETY AND CLINICAL
EFFICACY IN JOINT DISEASE,
PRELIMINARY DATA.**

ABSTRACT

The article discusses preliminary results of laser acupuncture with Multiwave Locked System in osteoarticular diseases. Laser acupuncture is a modern technique to stimulate acupoints without needling. The effects of laserpuncture on 67 adult outpatients are discussed. Laser acupuncture showed to be a safe and painless tool to manage osteoarticular pain. Parameters, dosages and modality are discussed: laserpuncture needs lower frequency and lower dosage than other laser's therapy protocols. Our results suggest that laserpuncture with MLS® could be a good non-pharmacological treatment in the management of chronic pain.

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YEAR 2014

JOURNAL

Energy For Health; 13: 4-8

**A PREDICTIVE ANALYSIS OF
THERMAL EFFECTS IN PIGMENTED
SKIN AND UNDERLYING TISSUES
DURING IR LASER THERAPY.**

ABSTRACT

Infrared lasers are widely used in sport medicine and rehabilitation for their ability to induce a selective heating of localized portions of tissue. The desired effect is optimized by varying laser parameters (wavelength, emission modality, power). In this work we present a modelling study aimed at analyzing the thermal effects in the skin in dependence of irradiation conditions (treatment time and scanning mode of the laser probe) and skin pigmentation. The modelling study has been supported by a preliminary experimental study in albino and black mice. The results highlighted the dependence of the temperature values reached in different types of skin, on the concentration of epidermal melanosomes: the same laser induced thermal effects below the threshold of thermal damage in a light pigmented skin (45°C for a 5s arthrosis treatment) and might induce thermal damage in a dark pigmented skin (65°C in the same conditions).

Moreover, it has been found out that the scanning mode of the laser light may be modulated in order to induce different thermal regimens in the skin (outer layers and deep layers). This predictive analysis may be used as an effective tool to draft guidelines for laser therapies as well as to design personalized clinical protocols.

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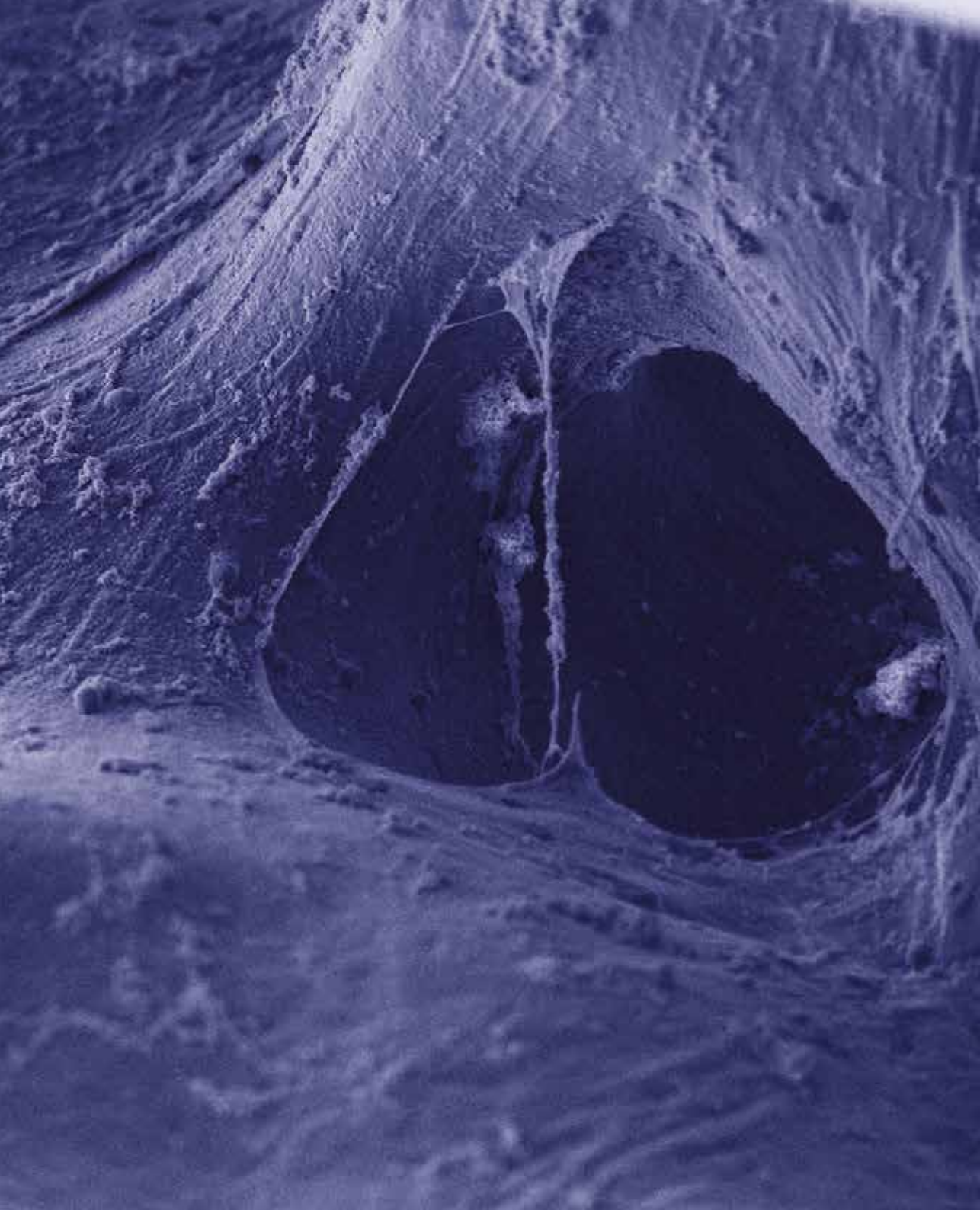
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YEAR 2014

JOURNAL

Energy For Health; 12: 4-10



**INFLUENCE OF MLS LASER
RADIATION ON ERYTHROCYTE
MEMBRANE FLUIDITY AND
SECONDARY STRUCTURE OF
HUMAN SERUM ALBUMIN.**

ABSTRACT

The biostimulating activity of low level laser radiation of various wavelengths and energy doses is widely documented in the literature, but the mechanisms of the intracellular reactions involved are not precisely known. The aim of this paper is to evaluate the influence of low level laser radiation from an multiwave locked system (MLS) of two wavelengths (wavelength = 808 nm in continuous emission and 905 nm in pulsed emission) on the human erythrocyte membrane and on the secondary structure of human serum albumin (HSA). Human erythrocytes membranes and HSA were irradiated with laser light of low intensity with surface energy density ranging from 0.46 to 4.9 J cm⁻² and surface energy power density 195 mW cm⁻² (1,000 Hz) and 230 mW cm⁻² (2,000 Hz). Structural and functional changes in the erythrocyte membrane were characterized by its fluidity, while changes in the protein were monitored by its secondary structure. Dose-dependent changes in erythrocyte membrane fluidity were induced by near-infrared laser radiation. Slight changes in the secondary structure of HSA were also noted. MLS laser radiation influences the structure and function of the human erythrocyte membrane resulting in a change in fluidity.

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YEAR 2014

JOURNAL

Mol Cell Biochem; 388: 261–267

**THE EFFECT OF
NEAR-INFRARED MLS
LASER RADIATION ON CELL
MEMBRANE STRUCTURE
AND RADICAL GENERATION.**

ABSTRACT

The therapeutic effects of low-power laser radiation of different wavelengths and light doses are well known, but the biochemical mechanism of the interaction of laser light with living cells is not fully understood. We have investigated the effect of MLS (Multiwave Locked System) laser near-infrared irradiation on cell membrane structure, functional properties, and free radical generation using human red blood cells and breast cancer MCF-4 cells. The cells were irradiated with low-intensity MLS near-infrared (simultaneously 808 nm, continuous emission and 905 nm, pulse emission, pulse-wave frequency, 1,000 or 2,000 Hz) laser light at light doses from 0 to 15 J (average power density 212.5 mW/cm(2), spot size was 3.18 cm(2)) at 22 °C, the activity membrane bound acetylcholinesterase, cell stability, anti-oxidative activity, and free radical generation were the parameters used in characterizing the structural and functional changes of the cell. Near-infrared low-intensity laser radiation changed the acetylcholinesterase activity of the red blood cell membrane in a dose-dependent manner: There was a considerable increase of maximal enzymatic rate and Michaelis constant due to changes in the membrane structure. Integral parameters such as erythrocyte stability, membrane lipid peroxidation, or methemoglobin levels remained unchanged. Anti-oxidative capacity of the red blood cells increased after MLS laser irradiation. This irradiation induced a time-dependent increase in free radical generation in MCF-4 cells. Low-intensity near-infrared MLS laser radiation induces free radical generation and changes enzymatic and anti-oxidative activities of cellular components. Free radical generation may be the mechanism of the biomodulative effect of laser radiation.

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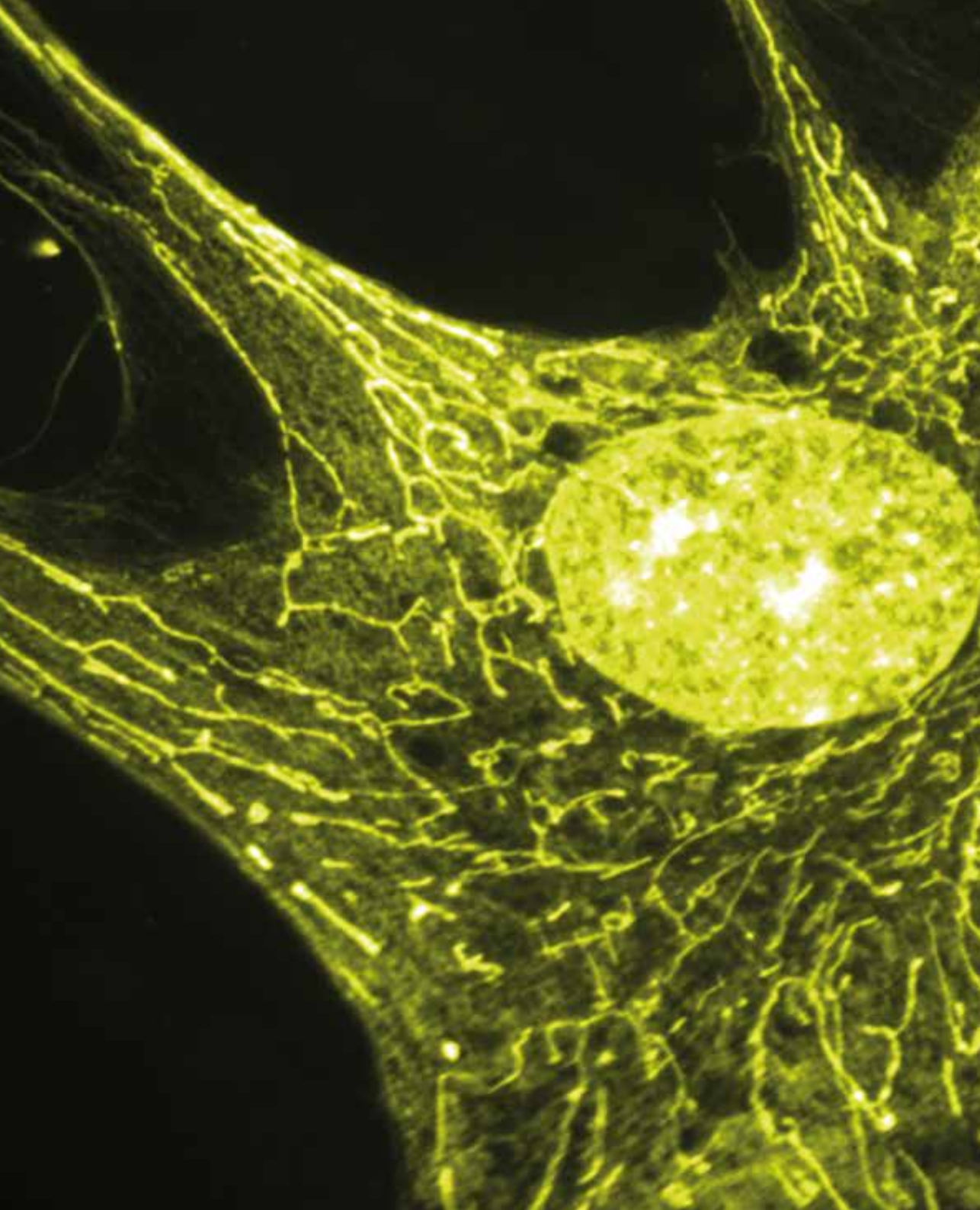
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YEAR 2014

JOURNAL

Lasers in Medical Science; 29(5): 1663-
1668



THE INFLUENCE OF MULTIWAVE LOCKED SYSTEM (MLS) LASER THERAPY ON CLINICAL FEATURES, MICROCIRCULATORY ABNORMALITIES AND SELECTED MODULATORS OF ANGIOGENESIS IN PATIENTS WITH RAYNAUD’S PHENOMENON.

ABSTRACT

The aim of this study was to investigate the influence of the Multiwave Locked System (MLS) laser therapy on clinical features, microvascular changes in nailfold videocapillaroscopy (NVC) and circulating modulators releasing as a consequence of vascular endothelium injury such as vascular endothelial growth factor (VEGF) and angiopoietin 2 (Ang-2) in patients with primary and secondary Raynaud’s phenomenon. Seventy-eight RP patients and 30 healthy volunteers were recruited into the study. All patients with RP received MLS laser irradiation for 3 weeks. Clinical, NVC and laboratory investigations were performed before and after the MLS laser therapy. The serum concentration of VEGF and Ang-2 were determined by an enzyme-linked immunosorbent assay (ELISA). After 3 weeks of MLS laser therapy, the clinical improvement manifested by decreasing of the number of RP attacks, mean duration of Raynaud’s attack and pain intensity in RP patients was observed. After MLS laser therapy in 65 % of patients with primary and in 35% with secondary RP, an increase in the loop number and/ or a reduction in avascular areas in NVC were observed. In comparison with a control group, higher serum concentration of VEGF and Ang-2 in RP patients was demonstrated. After MLS laser therapy, a reduction of Ang-2 in both groups of RP patients was found. Our results suggest that NVC may reflect microvascular changes associated with clinical improvement after MLS laser therapy in patients with primary and secondary RP. Ang-2 serumlevels may be a useful marker of microvascular abnormalities in RP patients treated with MLS laser therapy.

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YEAR 2014

JOURNAL

Clinical Rheumatology; 34(3): 489-496

THE EFFECT OF MLS LASER THERAPY IN ÉLITE FOOTBALL PLAYERS AFFECTED BY MUSCLES INJURIES: A CONTROLLED CLINICAL TRIAL.

ABSTRACT

Muscle injuries are frequent in elite football players, with a percentage of 30-40% of all injuries. The 22% of total injuries are muscular relapses. The focus of this study was to evaluate how the laser therapy could modify the recovery time in elite football player. The treatments have been performed with a Multiwave Locked System (MLS) laser. The sample group of football players was divided into two groups: the first group has been subjected to the standard rehabilitation program without MLS laser irradiation, the second group has been treated with the new rehabilitation program that included laser therapy. We compared the average injury’s duration in the two groups to establish the efficacy of the MLS laser treatment in accelerating rehabilitation. In spite of a positive trend observed in the laser-treated group, which showed a decrease of the recovery time on the basis of the lesions considered, the difference in comparison with the control group was not statistically significant, also due to the low number of patients considered. Therefore, the results suggest that laser therapy could be useful to shorten the recovery time after muscle injury, but further studies with a larger number of cases are required to statistically demonstrate the efficacy of the MLS laser therapy.

AUTHORS

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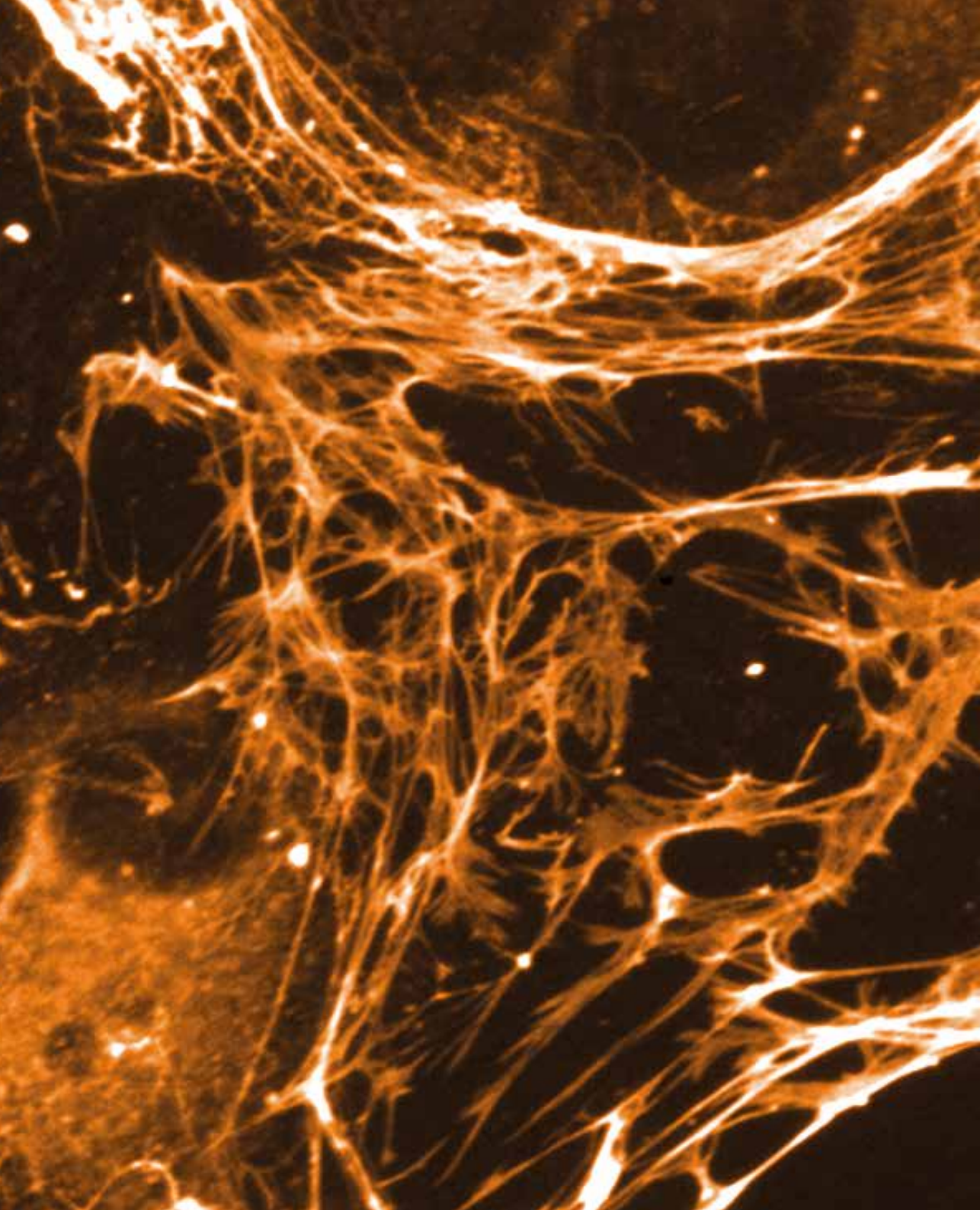
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YEAR 2013

JOURNAL

Energy For Health; 10: 4-8



**EFFECT OF IR LASER
ON MYOBLASTS:
A PROTEOMIC STUDY.**

ABSTRACT

Laser therapy is used in physical medicine and rehabilitation to accelerate muscle recovery and in sports medicine to prevent damages produced by metabolic disturbances and inflammatory reactions after heavy exercise. The aim of this research was to get insight into possible benefits deriving from the application of an advanced IR laser system to counteract deficits of muscle energy metabolism and stimulate the recovery of hypotrophic tissue. We studied the effect of IR laser treatment on proliferation, differentiation, cytoskeleton organization and global protein expression in C2C12 myoblasts. We found that laser treatment induced a decrease in the cell proliferation rate without affecting cell viability, while leading to cytoskeletal rearrangement and expression of the early differentiation marker MyoD. The differential proteome analysis revealed the up-regulation and/or modulation of many proteins known to be involved in cell cycle regulation, cytoskeleton organization and differentiation.

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YEAR 2013

JOURNAL

Molecular Biosystems, 9 (6): 1147-61

COMPARISON OF ANALGESIC AND ANTI-INFLAMMATORY EFFECTS OF THE CLASSICAL LOW LEVEL LASER THERAPY AND MULTIWAVE LOCKED SYSTEM IN INFLAMMATIONS OF SEROUS BURSAE.

ABSTRACT

Introduction. Infrared thermography is a non-invasive physiological test that since 1990 was recognized as a diagnostic tool by the American Academy of Physical Medicine and Rehabilitation. The method is based on the identification and the quantification of coetaneous thermal asymmetry. Several studies were conducted in time, showing thermographic variations in some soft tissue conditions.

Objectives. This study compares the anti-inflammatory and analgesic effect of classical laser therapy and multi-wave locked system (MLS) laser therapy by following the evolution of differences in temperature between the affected area and the unaffected controlateral area and the evolution of pain measured by visual analog scale (VAS).

Material and method. I divided the patients in the study into two groups: a group of patients received classic laser therapy and a group of patients received MLS laser therapy.

Results. In both group, the evolution of studied parameters (pain measured by visual analog scale and thermal gradient) demonstrate the efficiency of laser therapy in treating bursitis, yet the decrease of differences in temperature and of VAS score was steeper in the group under MLS therapy, the dissimilarity between the groups being relevant statistically.

Conclusions. Laser therapy demonstrate both an analgesic (evidenced by the relieve pain) and anti-inflammatory effect (evidenced by reduction of the thermal gradient) for bursitis affecting superficial bursae and the difference between this two types of laser therapy are statistically significant (MLS therapy has a greater analgesic and anti-inflammatory effect compared with low level laser therapy).

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JOURNAL

Sports Medicine Journal / Medicina Sportiva; 9 (4): 2234-2240

THE EFFECT OF MLS THERAPY ON NERVE CONDUCTION PARAMETERS IN DEVELOPING DIABETIC SENSORY PERIPHERAL NEUROPATHY.

ABSTRACT

The MLS laser is composed of an 808nm continuous emission laser and a 905nm pulsed emission laser that are synchronized. The purpose of this study was to determine the effect of the MLS laser on the injured tibial and peroneal nerves in diabetic sensory neuropathy. The sural nerve was chosen as an untreated control nerve. A controlled prospective study was performed on ten patients with documented type 2 diabetes and peripheral sensory neuropathy. Nerve conduction parameters were determined prior to therapy and reevaluated post therapy. The course of therapy was three weeks. F-wave chronodispersion (Fc) measurements at the completion of the study showed significant improvement with this therapy. Peroneal Fc went from 8.99ms to 6-19ms ($p=.015$). Tibial Fc went from 10.30ms to 6-97ms ($p=.001$). The MLS laser therapy produced objective improvement in nerve function for persons with developing diabetic sensory neuropathy.

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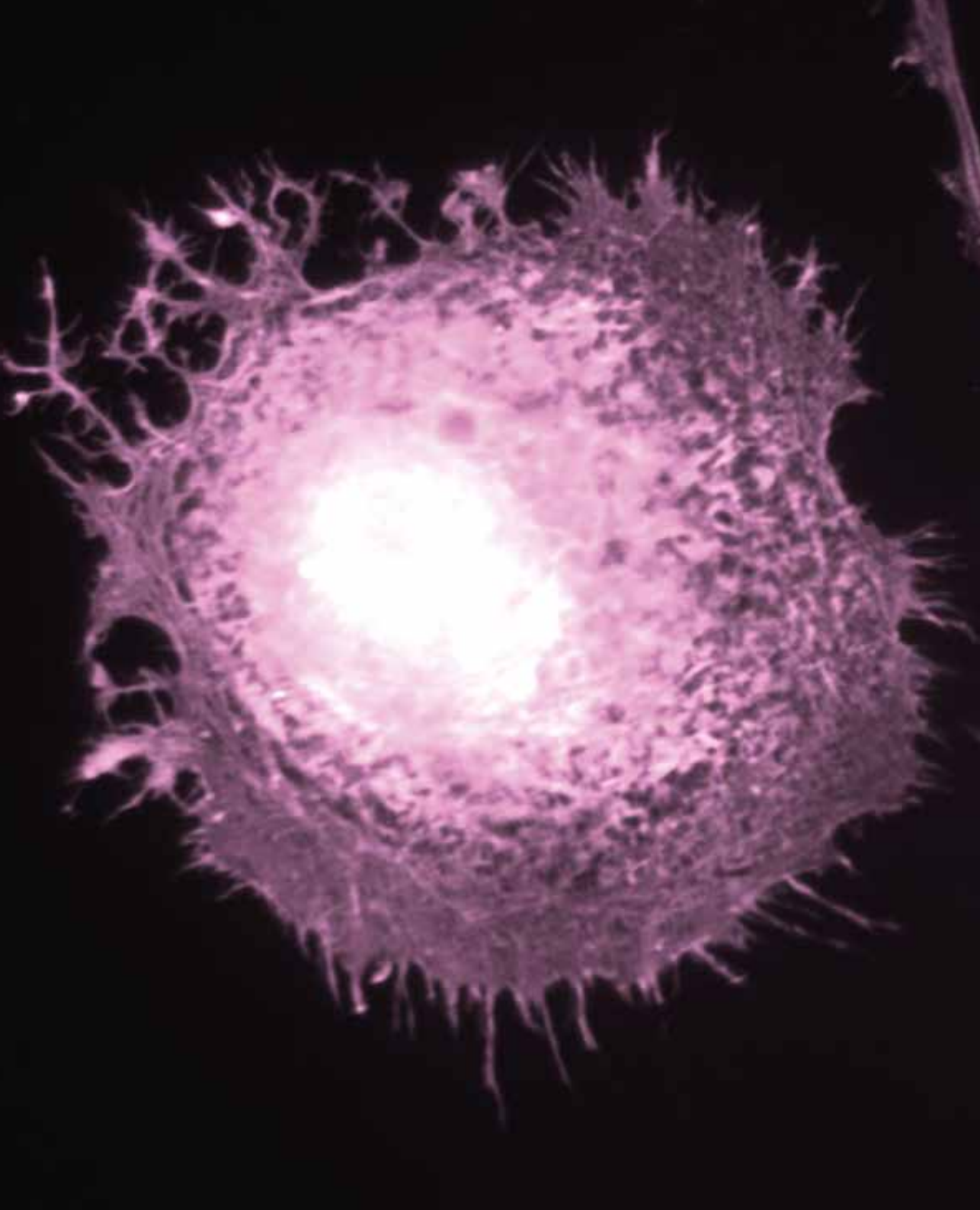
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YEAR 2012

JOURNAL

Energy for Health; 9: 4-7



**EFFECT OF MLS LASER
RADIATION ON THE ATPase
ACTIVITY OF HUMAN
ERYTHROCYTE MEMBRANES.**

ABSTRACT

Background. Therapeutic effects of low-energy laser radiation at different wavelengths and doses of energy is well known, but the exact mechanism of action of light on living cells is not yet known.

Objectives. The aim of this study was to investigate the effect of MLS (Multiwave Locked System) laser emitting radiation of two wavelengths (808 nm in the continuous emission and 905 nm in the pulse emission) on human red blood cell membrane.

Materials and methods. Human erythrocytes were irradiated low-intensity laser radiation at different energy doses (0-15 J). As the parameters characterizing the structural and functional erythrocyte membrane changes ATPase enzyme activity was adopted.

Results. In the suspensions of membranes exposed to low-energy near-infrared laser radiation the dose-dependent changes of ATPase activity in blood cell membrane were found.

Conclusions. The study shows that a single exposure of erythrocyte membranes to MLS laser radiation causes changes in membrane enzymes activity.

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YEAR 2012

JOURNAL

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A PROSPECTIVE, RANDOMIZED AND PLACEBO CONTROLLED STUDY OF THE EFFICACY OF TREATMENT WITH LASER, WITH OR WITHOUT SPLINTING OF WRIST IN IDIOPATHIC CARPAL TUNNEL SYNDROME.

ABSTRACT

Objective. To evaluate incidence by gender in the carpal tunnel syndrome (CTS), the evolution in those treated with real laser (rL) versus those treated with placebo laser (pL), both groups without orthosis; evolution of wrist treated with rL plus orthosis versus those treated with rL without orthosis and evolution of wrist treated with rL + orthosis versus those treated with pL without orthosis.

Materials and methods. A total of 49 patients with CTS with mild or moderate involvement were selected. They were treated with laser 808 and 905nm and 25W peak power. In 15 patients, treatment was associated to orthosis in the most affected hand. In 12 patients, both hands were affected and orthosis was not used in 22. Total energy applied/session was 915 J/cm² on an area of 4x4cm².

Statistical analysis. The SPSS 15.0, Student's T test was used, with significant values for P<.05, corroborated with the Wilcoxon rank sum test.

Results. The incidence was much higher in women (93.5%). In patients with orthosis, there are significant differences in all the values in the lasertreated subjects versus the placebo-laser treated ones. When orthosis was not used, there were significant differences between those treated with real laser versus those treated with placebo. In patients treated with laser and orthosis versus those treated with laser without orthosis, no significant differences were found. When patients treated with laser plus orthosis were compared with those treated with pL without orthosis, very significant differences were found in favor of the former. There are no significant differences between the values obtained at the first and third month of treatment.

Conclusions. Treatment with laser in CTS patients is more effective than placebo up to three months after the treatment has been completed. The use of orthotic devices and laser is no more effective than the use of laser alone.

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YEAR 2012

JOURNAL

Rehabilitación (Madr); 46(2): 92-102

COMPARATIVE EVALUATION OF THE DIRECT ANALGESIC EFFICACY OF SELECTED PHYSIOTHERAPEUTIC METHODS IN SUBJECTS WITH KNEE OSTEOARTHRITIS. PRELIMINARY REPORT.

ABSTRACT

Background. The goals of the study were to evaluate the efficacy of two physiotherapeutic procedures: low energy laser therapy and low frequency transcutaneous electric nerve stimulation (TENS) and to compare these modalities with regard to their therapeutic effects in patients with knee osteoarthritis.

Material and methods. Fifty subjects were enrolled into the study and divided into two groups of 25 subjects. Group A received 10 MLS laser therapy sessions with a synchronised laser beam at doses of 12 J per treated site. Group B received ten sessions of low frequency TENS. The procedures were carried out every day for two weeks (5 times a week). All patients completed a personal data questionnaire and underwent an examination of knee joint motion range and circumference. Subjective pain intensity was assessed using the VAS pain scale and the modified Laitinen questionnaire.

Results. An analysis of the results of the treatment demonstrated statistically significant pain reduction in both groups. This improvement was significantly higher in the two-phase laser therapy group vs. the LF-TENS group. No statistically significant improvement was noted in either of the groups regarding the knee joint range of motion.

Conclusions. 1. Synchronised laser beam (MLS) therapy and low-frequency TENS contribute to direct pain relief effects in subjects with knee osteoarthritis. 2. The study confirmed better analgesic effects of two-phase laser therapy vs. LF-TENS.

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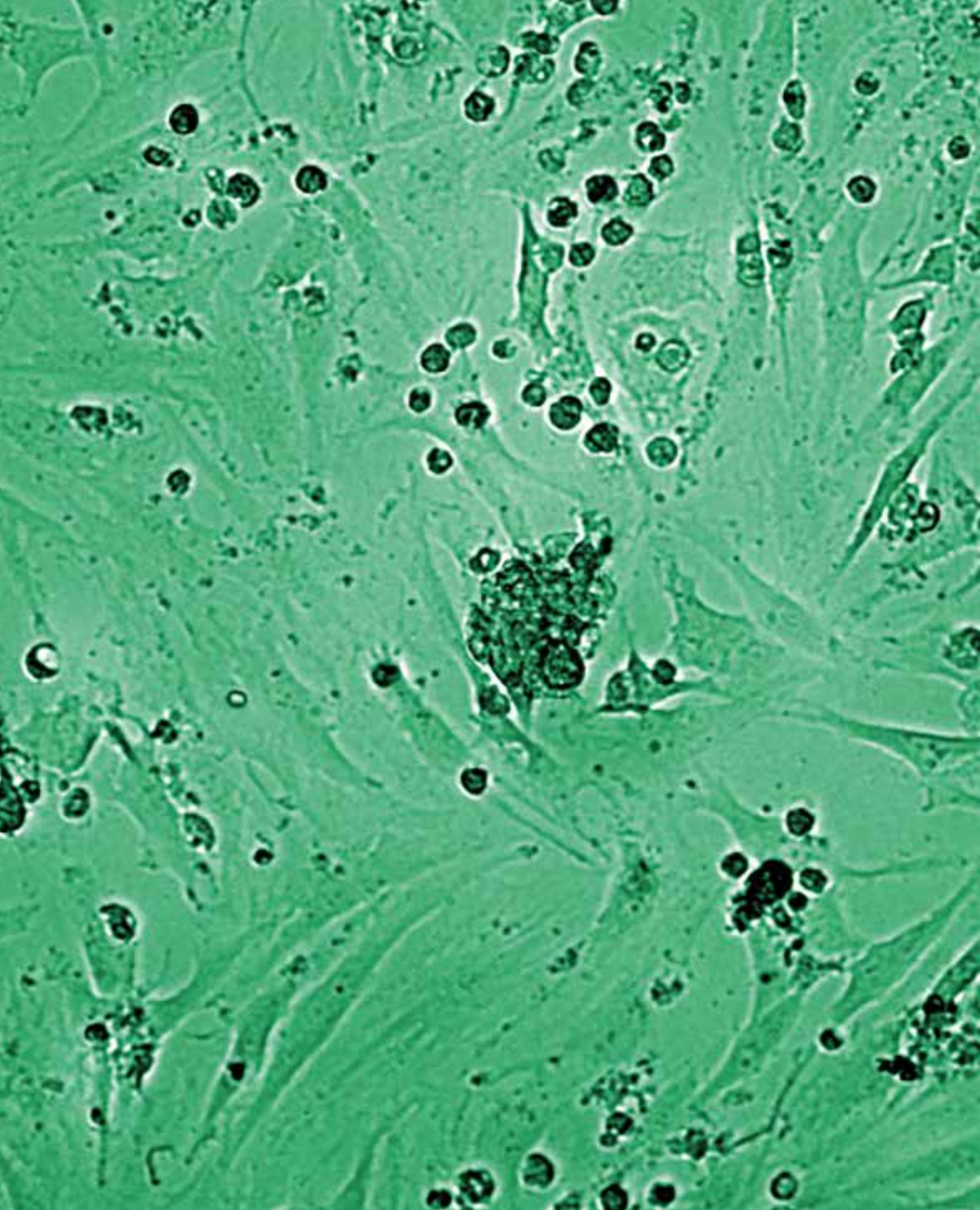
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YEAR 2012

JOURNAL

Ortop Traumatol Rehabil.;14 (6): 537-44



**EFFECT OF IR LASER ON MYOBLASTS:
PROSPECTS OF APPLICATION
FOR COUNTERACTING
MICROGRAVITY-INDUCED
MUSCLE ATROPHY.**

ABSTRACT

Microgravity-induced muscle atrophy is a problem of utmost importance for the impact it may have on the health and performance of astronauts. Therefore, appropriate countermeasures are needed to prevent disuse atrophy and favour muscle recovery. Muscle atrophy is characterized by loss of muscle mass and strength, and a shift in substrate utilization from fat to glucose, that leads to a reduced metabolic efficiency and enhanced fatigability. Laser therapy is already used in physical medicine and rehabilitation to accelerate muscle recovery and in sports medicine to prevent damages produced by metabolic disturbances and inflammatory reactions after heavy exercise. The aim of the research we present was to get insights on possible benefits deriving from the application of an advanced infrared laser system to counteract deficits of muscle energy metabolism and stimulate the recovery of the hypotrophic tissue. The source used was a Multiwave Locked System (MLS) laser, which combines continuous and pulsed emissions at 808 nm and 905 nm, respectively. We studied the effect of MLS treatment on morphology and energy metabolism of C2C12 cells, a widely accepted myoblast model, previously exposed to microgravity conditions modelled by a Random Positioning Machine. The MLS laser treatment was able to restore basal levels of serine/threonine protein phosphatase activity and to counteract cytoskeletal alterations and increase in glycolytic enzymes activity that occurred following the exposure to modelled microgravity. In conclusion, the results provide interesting insights for the application of infrared laser in the treatment of muscle atrophy.

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YEAR 2012

JOURNAL

Microgravity Science And Technology;
25(1): 35-42

INFLUENCE OF VARIOUS LASER THERAPY METHODS ON KNEE JOINT PAIN AND FUNCTION IN PATIENTS WITH KNEE OSTEOARTHRITIS.

ABSTRACT

Background. The aim of the study was to estimate the influence of various laser therapy methods on knee joint pain and function in patients with knee osteoarthritis.

Material and methods. 125 patients were randomly assigned to 4 groups: Group I received one-wave laser irradiation (wave length 810 nm, dose 8 J/point), Group II received two-wave MLS laser irradiation (power 1100 mW, frequency 2000 Hz, dose 12.4 J/point), Group III received a similar regimen of two-wave MLS laser irradiation, but at a dose of 6.6 J per point, Group IV was a placebo group where laser therapy procedures were simulated without actual irradiation. The effectiveness of the therapy was evaluated by means of Lequesne's scale, a modified Laitinen questionnaire and a visual analogue scale (VAS). Statistical analysis utilised non-parametric Wilcoxon's and Mann-Whitney's tests. Calculations were carried out with MedCalc v. 11.6.1.0.

Results. Statistically significant improvements in knee joint function and pain relief were seen in all Groups (I, II and III). When Groups I, II and III were compared, the largest improvement was found in Group II (MLS laser, dose 12.4 J/point). The degrees of improvement in Groups I and III were similar.

Conclusions. One-wave laser irradiation at a dose of 8 J per point and two-wave laser irradiation with doses of 12.4 J and 6.6 J per point significantly improved knee joint function and relieved knee pain in patients with osteoarthritis.

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YEAR 2012

JOURNAL

Ortop Traumatol Rehabil.;14 (3): 269-77

THE MLS THERAPY IN POSTURAL MYOFASCIAL PAIN AND POSTRAUMATICAL OF THE NECK.

ABSTRACT

Myofascial pain is a common cause of chronic syndromes, not only of orofacial district, but also any other district; such painful syndromes often mimic other disorders, in relation to their location, and are still often be denied or underestimated. Myofascial pain is usually in an area known as Trigger points (TrPs). Laser therapy has been often proposed for the treatment of pain and disability management of various disorders. In comparison to the classical laser therapy, MLS therapy has several special characteristics: it combines laser emissions with two wavelengths (808 and 905 nm), one in the continuous mode (808 nm, with a maximum power of 1W), and the other one in a pulsed mode (905 nm, with a peak power of 25 W). The advantage of this laser system consists in better propagation inside the tissue respect to other wavelengths and in the possibility of increasing the emitted energy. The aim of the study was to analyze the efficacy of MLS in patients with myofascial pain. 30 patients with myofascial pain in the cervical region were enrolled in the study. The patient's evaluation included Visual Analogue Scale (VAS) and Neck Pain Disability Questionnaire that is a multidimensional questionnaire assessment of pain, disability and cognitive-behavioural aspects linkable to cervicalgia. The symptoms of pain was evaluated through the VAS scale, at the end of each session of MLS therapy and after one month after the end of treatment. Pain relief was good in both cases. MLS therapy has proven to be very effective in post traumatic myofascial pain. Myofascial postural pain needs a series of actions such as postural gymnastics that might improve the result.

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JOURNAL

Energy For Health; 9: 8-11

**APPLICATION OF MLS LASER
ON MUSCULAR CONTRACTURE
CAUSED BY FUNCTIONAL
OVERLOAD IN A YOUNG
ATHLETE - CASE REPORT.**

ABSTRACT

Myalgic fatigue (or muscular contracture caused by functional overload) is clinically detected as an unpleasant feeling of one or more muscles, that appears within 24 hours after exercise and disappears in 5-7 days. In athletes, often the muscular contracture is not due to pathological alterations of muscle metabolism, but rather to a condition of lack of training, as typically happens at the beginning of the training season or after a period of enforced rest due to trauma or injury. Laser therapy has long been widely used to treat muscle pain and contracture, and recently it has also been proposed to prevent injuries from overwork in athletes. The aim of this study was to evaluate the efficacy of an advanced IR laser system, the MLS laser, in combination with the other components of standard therapy for the treatment of muscular contracture. MLS system is a laser device with special characteristics: it is equipped with synchronized combination of continuous and pulsed emissions. The first one (that may emit also in pulsed mode) with $\lambda=808$ nm and maximum power of 1W, the other one with $\lambda=905$ nm and peak power of 25W. Here we report the case of a 16 years old athlete in good health state and with no previous muscle injury. The athlete reported a rectus femoris pain after a work of multiple running on 200 meters. After 3 days of MLS treatment, associated with mobilization of the muscle, stretching and eccentric contraction exercise, the athlete reported negative clinical examination for pain and muscle contracture and was available to work with the team. Studies are in progress to confirm our findings increasing the number of cases and also evaluating the efficacy of MLS laser therapy on different types of injury.

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JOURNAL

Energy for Health; 9: 12-14

**PHYSICAL TREATMENT
OF POST TRAUMATIC
GONALGIA BY
NIR LASER THERAPY:
A CASE REPORT.**

ABSTRACT

In this paper we present a case report that refers to a female patient, aged 54, who suffered from post-traumatic knee pain. The clinical case described was part of a clinical trial whose purpose was to investigate the therapeutic effects of NIR laser therapy on knee pain. The laser source was a Multiwave Locked System (M6 device) provided by ASA s.r.l. (Arcugnano, Vicenza, Italy). The instrument consisted of two assembled laser diodes with synchronized emissions at 808 and 905 nm, respectively. The patient was treated 3 times weekly, for a total of 10 treatments. The patient's pain, both before and after each session, was measured by using VAS scale, in order to evaluate the effect of the laser therapy. The data obtained show that, during the treatment, the patient had a progressive improvement in pain relief. At 60 days follow-up, it was observed that the effect of laser therapy persisted. The results we obtained in this study indicate that, with the chosen laser source (MLS) and treatment parameters, NIR laser therapy had beneficial effects on knee pain.

AUTHORS

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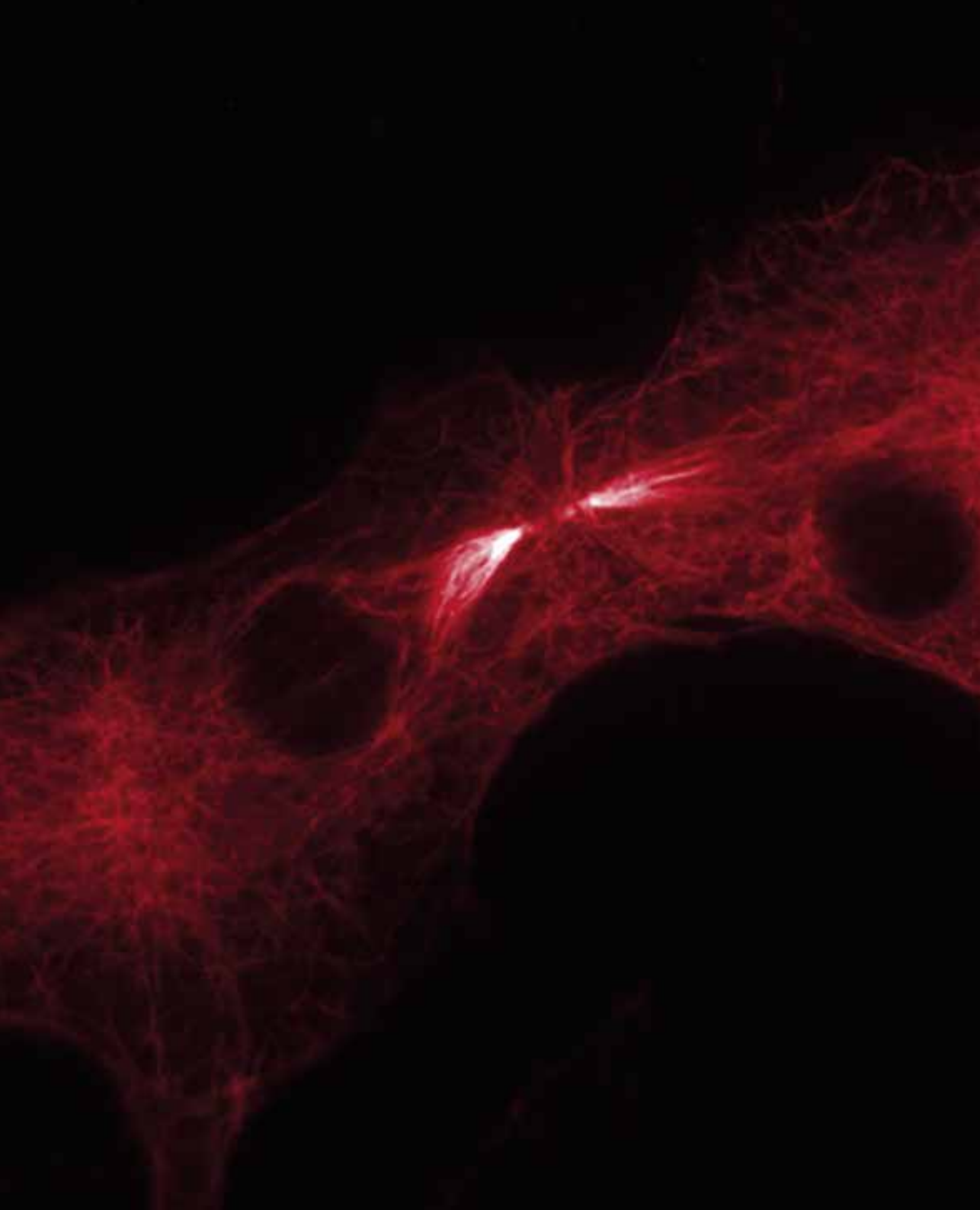
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JOURNAL

Energy for Health; 9: 15-17



**EFFECTS OF MLS
LASER ON MYOBLAST
CELL LINE C2C12.**

ABSTRACT

Laser is widely used in many medical fields and its effects are reported by several studies in literature. Very important are the applications in sports medicine, physical medicine and rehabilitation, based on the analgesic, anti-inflammatory and anti-oedema effects of laser therapy, as well as the stimulating action on tissue repair processes. In our study, we analyzed the effects of an advanced laser system, the Multiwave Locked System (MLS), on myoblasts in order to evaluate the effectiveness of this laser in promoting recovery of damaged muscle tissue. The MLS device consists of two synchronized diodes emitting at 808 and 905 nm, respectively. C2C12 murine myoblasts cell line was used as experimental model since it is a widely accepted model in muscle cells behavior studies. Viability and proliferation was assessed after a single treatment as well as after 4 consecutive treatment (1 treatment/day). No significant changes were observed in viability, while proliferation decreased after 4 treatments. Moreover, we found an increased expression of MyoD, a key factor in myoblasts maturation. Changes in cytoskeleton organization, in particular the networks of actin microfilaments and microtubules, were also observed. Decreased proliferation rate, increased MyoD expression and cytoskeleton rearrangement are consistent with myoblast differentiation. Finally the expression of molecules involved in the regulation of extracellular matrix (EC M) turnover (collagen I, MMP-2, MMP-9) was analyzed. After 4 treatments, collagen I expression showed a 14% increase while MMP-2 and MMP-9 decreased of 33% and 18%, respectively. These results suggest that MLS treatment could affect EC M turnover shifting the balance toward the production rather than to the degradation. In conclusion, our findings demonstrate that MLS treatment induces in muscle cells a biological response that could favour muscle cell differentiation and the recovery of diseased muscle tissue. A deeper knowledge of the mechanisms underlying the effects described above and a greater understanding of the changes in the biological response to variations in instrumental parameters setting can lead to concrete improvements in treatment protocols.

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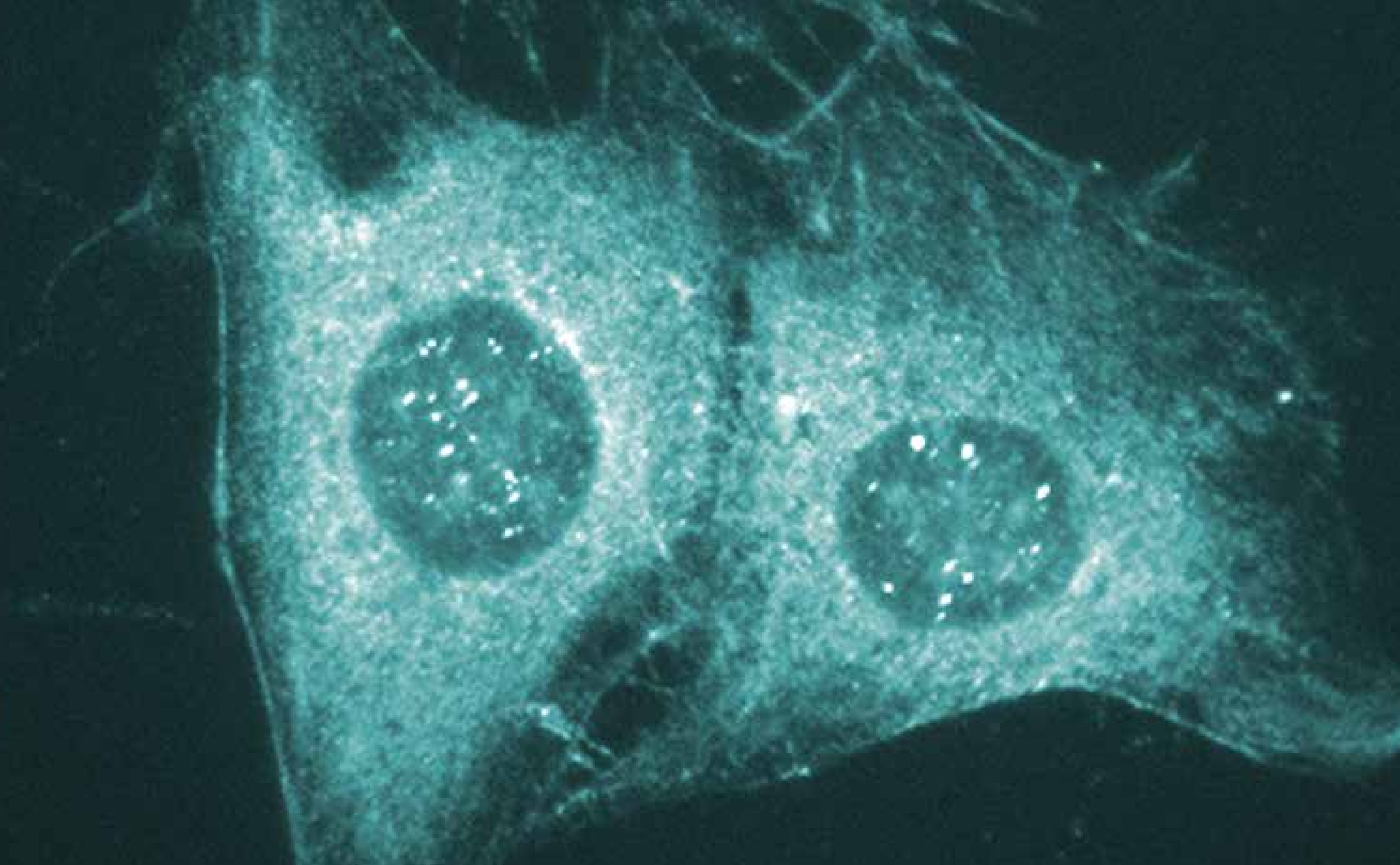
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YEAR 2011

JOURNAL

Energy For Health; 7: 12-18



**MLS LASER TREATMENT:
A TOOL TO COUNTERACT
MICROGRAVITY-INDUCED
MUSCLE ATROPHY.**

ABSTRACT

It is well known that muscle atrophy, together with bone loss and impairment of immune system, is a major problem in space missions and countermeasures are needed to prevent disuse atrophy and favour muscle recovery. Studies on microgravity-induced muscle atrophy demonstrated that it is associated with a shift in substrate utilization from fat to glucose, altered mitochondrial function, increase in ATP consumption per force-time-integral, indicating a reduced metabolic efficiency. Lasertherapy is already used in sports medicine to accelerate muscle recovery after exercise and prevent damages produced by metabolic disturbances and inflammatory reactions after heavy exercise (Leal Junior et al., 2009). The aim of the research we present was to get insights on possible benefits deriving from the application of an advanced laser system to counteract deficits of muscle energy metabolism. The laser source was a Multiwave Locked System (MLS), which combines continuous/pulsed emissions at 808 nm and 904 nm., respectively. We used the C2C12 cell line, a myoblast model, to study the effect of MLS treatment on cell energy metabolism. Cells were treated 8 min daily for 4 consecutive days (frequency 1500 Hz, energy 198,2 J, fluence 2J/cm² in 10 sec). Intracellular redox state was evaluated by autofluorescence (AF) microscopy (Schneckenburger and König, 1992). Glucose 6-P dehydrogenase (G6PDH), isocitrate dehydrogenase (ICDH), malate dehydrogenase (MDH), glyceraldehyde 3-P dehydrogenase (GAPDH), hexokinase, enolase, pyruvate kinase (PK), triosephosphate isomerase (TIM), hydroxyacylCoA dehydrogenase and lactate dehydrogenase (LDH) activities were determined continuously, following NAD(P) reduction or NADH oxidation at 340nm, using an UV-2100 spectrophotometer (Shimadzu, Columbia, MD). To investigate the different protein expression in C2C12 cells and controls a comparative proteome analysis was performed. Proteins were extracted, resolved by 2-D SDS-PAGE and the resulting colloidal coomassie stained electropherograms were analyzed using the Image Master 2D Platinum software. Identification of interesting proteins was carried out by MALDI-TOF MS. Finally, cell morphology, cytoskeleton organization and expression of MyoD, an early marker of myogenic commitment, were analyzed

by immunofluorescence microscopy and image analysis. After laser treatments cell AF decreased of about 40% . The activity of MDH, LDH, PK, GAPDH and TIM increased. Proteome analysis pointed out about 150 quantitative variations between control and laser treated cells, while about 20 and 50 spots were exclusively detected in control and laser treated cells, respectively. Immunofluorescence microscopy showed an increase of about 20% in MyoD expression, rearrangement of actin microfilaments and microtubules. Increase in activity of key enzymes and changes in the turnover of reduced/oxidized forms of pyridinic coenzymes and flavins demonstrate that MLS treatment strongly affect cell energy metabolism. Proteome analysis, cytoskeleton rearrangement and MyoD expression suggest that the treatment induces important changes in protein expression and cell morphology and could promote myogenic commitment.

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PROCEEDINGS

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**EFFICIENCY OF MLS
THERAPY IN ABARTICULAR
RHEUMATISM REVEALED BY
DIGITAL THERMOGRAPHY AND
VISUAL ANALOG SCALE.**

ABSTRACT

A lot of 22 patients with acute pathology soft-tissue injuries (shoulder periarthritis, tendinitis, epicondylitis, bursitis), which was divided into two groups. The first group (G1) received treatment with conventional electrotherapy (interferential or diadynamics current, ultrasound) and 100 mW laser. The second group (G2), received conventional therapy electrotherapy and MLS therapy. The aim of this study was to compare the analgesic and anti-inflammatory effect of the MLS laser therapy and the mono-channel laser treatment in abarticular rheumatism, by digital thermography (outlining the local anti-inflammatory effect by the decrease in the cutaneous temperature), soft tissue echography (visualization of tissular modifications) and by clinical methods (the visual analogue pain scale). The decrease of VAS values to 5 or 10 days of treatment is more important for MLS therapy. It is also apparent decrease in the temperature difference between the affected and the healthy area.

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JOURNAL

Energy for Health; 8: 12-16

**COMPARISON OF THE EFFECTS OF
LOW ENERGY LASER AND ULTRASOUND
IN TREATMENT OF SHOULDER MYOFASCIAL
PAIN SYNDROME: A RANDOMIZED SINGLE
BLINDED CLINICAL TRIAL.**

ABSTRACT

Background. Myofascial pain syndrome (MPS) is one of the most prevalent musculoskeletal diseases. MPS impaired quality of life in the patients. There is a lot of controversy about different treatment options which include medical treatments, physical therapy, injections, ultrasound and laser. The effects of laser in MPS are challenging.

Aim. To assess the effects of laser and ultrasound in treatment of MPS.

Design. Randomized single blinded clinical trial.

Setting. Outpatient physical therapy clinic at university hospital.

Population. Sixty three subjects (females: 46, males: 17), (age range: 17-55 year old) who had a diagnosis of definite MPS were entered in the study.

Methods. We measured the pain intensity at rest, during activity and at night using Visual Analogue Scale (VAS) questionnaire. The patients also filled the Neck Disability Index (NDI) form and the pain threshold provoked by pressure was determined using algometric assessment. Then, the patients were categorized randomly in groups A, B and C (receiving laser therapy, ultrasound and sham laser therapy, respectively). Six weeks after the initial visit, they were visited again and filled the forms again.

Results. Ultrasound was effective in VAS improvement during activity (46%), at rest (39%) and at night (35%). It also improved NDI scores (34%) and algometric assessment (37%). Laser was effective in VAS improving during activity (54%), at night (51%) and at rest (51%) and also improved NDI scores (73%). It was also found effective in algometric assessment improvement (105%). Laser resulted in more NDI score and algometric assessment improvements comparing to ultrasound ($p<0.05$).

Conclusion. This study introduces laser as one of the preferred treatments of myofascial pain syndrome in shoulder.

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JOURNAL

Eur J Phys Rehabil Med; 47: 391-90

**DIABETIC DISTAL SYMMETRIC
POLYNEUROPATHY:
EFFECT OF LOW-INTENSITY
LASER THERAPY.**

ABSTRACT

Low-intensity laser therapy (LILT) has been considered as a treatment modality in diabetic distal symmetric polyneuropathy (DSP). The aim of this study is to determine the effectiveness of LILT on DSP. We examined 107 subjects with type 2 diabetes for detection of DSP using the Michigan Neuropathy Screening Instrument (MNSI). Seventeen subjects were eligible to be enrolled in the study. Nerve conduction studies (NCS) were performed in all eligible subjects as an objective method to confirm neuropathy. The participants received LILT three times a week for ten sessions. NCSs were reevaluated after completion of the treatment. The absolute changes in NCS parameters were considered to establish the effectiveness of the treatment. Baseline demographics were similar in all participants. The mean differences of NCV parameters were considered for comparison. At the end of the study, the subjects showed a significant increase in neural potential amplitudes ($p<0.05$). This study clearly demonstrated a significant positive effect of LILT on improvement of nerve conduction velocity on diabetic distal symmetric polyneuropathy (DSP). This finding supports the therapeutic potential of LILT in DSP.

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JOURNAL

Lasers in Medical Science;
26 (6): 831-835

**MLS THERAPY TREATMENT
OF ACUTE SHOULDER PAIN IN
INFLAMMATORY PROCESSES
OF THE ROTATOR CUFF.**

ABSTRACT

This study evaluates the efficacy of MLS therapy for the treatment of acute pain in shoulder inflammation processes involving the rotator cuff. Twenty patients have been subjected to monotherapeutic treatment with MLS therapy. Pain symptoms were monitored using the Visual Analogy Pain Scale (VAS) and two other internationally recognized scales including the SSRS (Subiective Shoulder Rating Scale) and the SRQ (Shoulder Rating Questionnaire). After 10 treatment sessions, a significant reduction in pain symptoms and a good recovery of motor function was obtained. These results confirm the efficacy of the MLS therapy for treatment of shoulder pain arising from inflammation.

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JOURNAL

Energy For Health; 1: 12-15

**CELL GROWTH MODULATION
OF HUMAN CELLS IRRADIATED
IN VITRO WITH LOW-LEVEL
LASER THERAPY.**

ABSTRACT

Objective. The aim of this study was to investigate the effects of different wavelengths and doses of laser radiation on in vitro cell proliferation. We evaluated the biological effects of low-level laser therapy (LLLT) on two human cancer cell lines: HeLa (epithelial adenocarcinoma) and TK6 (lymphoblast). Our attention was focused on the combination of the two laser emissions as it could have a synergic effect greater than the single emission applied separately.

Background Data. The effects of LLLT on human cells are still poorly understood and unexplained. Several cell types were found non responsive to laser bio stimulation; in other cases, only a partial activation was observed.

Methods. A laser device was used for cell irradiation with a continuous wave diode (A = 808 nm), a pulsed wave diode (A = 905 nm), and a combined wave diodes (A = 808 nm + 905 nm), in the dose range of 1-60 .J/cm².

Results. The effect of the combined low-level 808-905-nm diode laser irradiation were slightly superior to those achieved with either laser alone in HeLa cells. TK6 cellular proliferation was not found to be significantly affected by any of the energy levels and varying exposure doses investigated.

Conclusions. Our results are a confirmation of previous observations carried out on human cells, where only the proliferation of slowly growing cell populations appeared to be stimulated by laser light.

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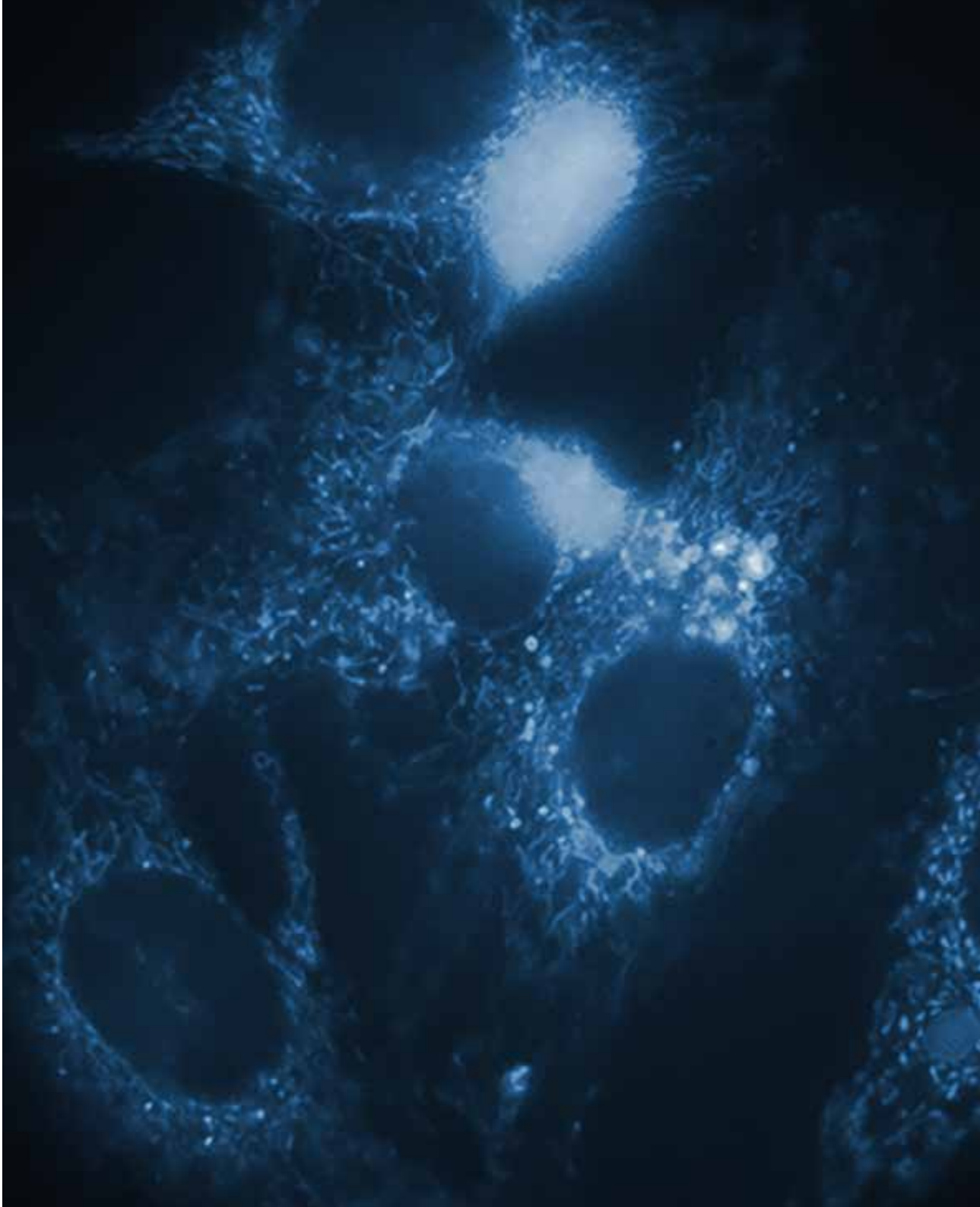
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JOURNAL

Photomedicine and laser Surgery (2004)
Vol 4; N.6 pg. 523-526



**LOW-POWER LASER BIOSTIMULATION
ENHANCES NERVE REPAIR AFTER
END-TO-SIDE NEURORRHAPHY:
A DOUBLE-BLIND RANDOMIZED STUDY
IN THE RAT MEDIAN NERVE MODEL.**

ABSTRACT

Previous studies have shown that low-power laser biostimulation (lasertherapy) promotes posttraumatic nerve regeneration. The objective of the present study was to investigate the effects of postoperative lasertherapy on nerve regeneration after end-to-side neurorrhaphy, an innovative technique for peripheral nerve repair. After complete transection, the left median nerve was repaired by end-to-side neurorrhaphy on the ulnar “donor” nerve. The animals were then divided into four groups: one placebo group, and three lasertreated groups that received lasertherapy three times a week for 3 weeks starting from postoperative day 1. Three different types of laser emission were used: continuous (808 nm), pulsed (905 nm), and a combination of the two. Functional testing was carried out every 2 weeks after surgery by means of the grasping test. At the time of withdrawal 16 weeks postoperatively, muscle mass recovery was assessed by weighing the muscles innervated by the median nerve. Finally, the repaired nerves were withdrawn, embedded in resin and analyzed by light and electron microscopy. Results showed that laser biostimulation induces: (1) a statistically significant faster recovery of the lesioned function; (2) a statistically significant faster recovery of muscle mass; (3) a statistically significant faster myelination of the regenerated nerve fibers. From comparison of the three different types of laser emissions, it turned out that the best functional outcome was obtained by means of pulsedcontinuous-combined laser biostimulation. Taken together, the results of the present study confirm previous experimental data on the effectiveness of lasertherapy for the promotion of peripheral nerve regeneration and suggest that early postoperative lasertherapy should be considered as a very promising physiotherapeutic tool for rehabilitation after end-to-side neurorrhaphy.

AUTHORS

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JOURNAL

Lasers in Medical Science; 19: 57–65

**CLINICAL RESULTS IN THE
TREATMENT OF ANKLE AND
KNEE DISTORTION PATHOLOGIES
WITH MLS THERAPY.**

ABSTRACT

The aim of this study has been to evaluate the effectiveness of MLS (Multiwave locked System) therapy on osteo-musculartendinous pathologies, like knee and ankle injury, until now not considered. Knee joint is a complex articular system extremely exposed to traumas and degenerative injuries; conversely, ankle supports body weight and, for this reason, is very vulnerable and subject to distortions. 28 patients were involved in the study, 11 with knee injury and 18 with ankle injury. The patients were exposed to a 10 day treatment with the M6 system (ASA, Arcugnano, Vicenza) which allows the automatic execution of the therapy. Using t-test, we compared the scores of the VAS scale before the MLS therapy, those before therapy but after physical examination and those immediately after treatment. The results obtained confirmed the effectiveness of MLS therapy on the time of remission of pain symptom and functional recovery.

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JOURNAL

Energy For Health; 1: 30-34

**MLS LASER THERAPY
TREATMENT OF SHOULDER
PAIN: A CONTROLLED
COMPARATIVE STUDY.**

ABSTRACT

Shoulder pain (periarthritis humeroscapularis) is a widespread problem that is difficult to resolve, as well as having a varied etiology.

This trial evaluated the effectiveness of treating this pathology with MLS Therapy, applied as a monotherapy, comparing the results with those obtained using traditional contact Laser therapy, in the presence of a suitable control group.

The results demonstrated that MLS Therapy is highly effective in inducing a fast reduction of painful symptoms and that this effect is greater than that obtained using traditional Laser therapy.

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YEAR 2004

JOURNAL

Scientific Report MLS

**MLS THERAPY
TREATMENT OF VARIOUS
OSTEO/MUSCOLAR/
TENDINOUS PATHOLOGIES.**

ABSTRACT

This study aimed to investigate the effectiveness of MLS Therapy treatment on various osteo/muscular/tendinous pathologies. 128 patients aged between 18 and 82 were treated with MLS Therapy for shoulder pain, lumbago, lumbosciatica, carpal or metatarsal tunnel syndrome and tension headache. Following treatment, significant remission of the painful symptoms was observed in all cases treated. The results confirm the therapeutic validity of the new MLS Therapy, as long as certain fundamental criteria are respected when establishing the therapeutic protocol.

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JOURNAL

Scientific Report MLS

**TREATING CHRONIC LUMBAGO
WITH MLS THERAPY.
A CONTROLLED TRIAL.**

ABSTRACT

This trial assessed the effectiveness of MLS Therapy in treating chronic lumbago. 30 patients affected with the illness were subjected to monotherapy with MLS Therapy, monitoring painful symptoms through the use of the Visual Analogue Scale (VAS). The results were compared with the progress of symptoms recorded in a homogeneous control group as regards numbers and composition. After 10 treatment sessions, a significant reduction in painful symptoms was observed and a fair amount of mobility was recovered. The above results confirm the effectiveness of MLS Therapy in treating chronic lumbago of a mechanical nature.

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JOURNAL

Scientific Report MLS

**LASER TREATMENT
OF CERVICAL DISTORTION.**

ABSTRACT

This study assessed the effectiveness of MLS Therapy treatment on post-traumatic cervical distortion. 20 patients affected with the disease were recruited and then treated with MLS Therapy. The results, based on an assessment of the subjective (VAS scale) and objective (articular mobility) parameters, confirm the therapeutic value of this new method. A comparison with existing results in literature regarding the effectiveness of the combined, unsynchronized emission demonstrates that the specific MLS synchronization leads to a synergy of the component emissions' therapeutic effects, guaranteeing shorter treatment times and particularly long-lasting results.

AUTHORS

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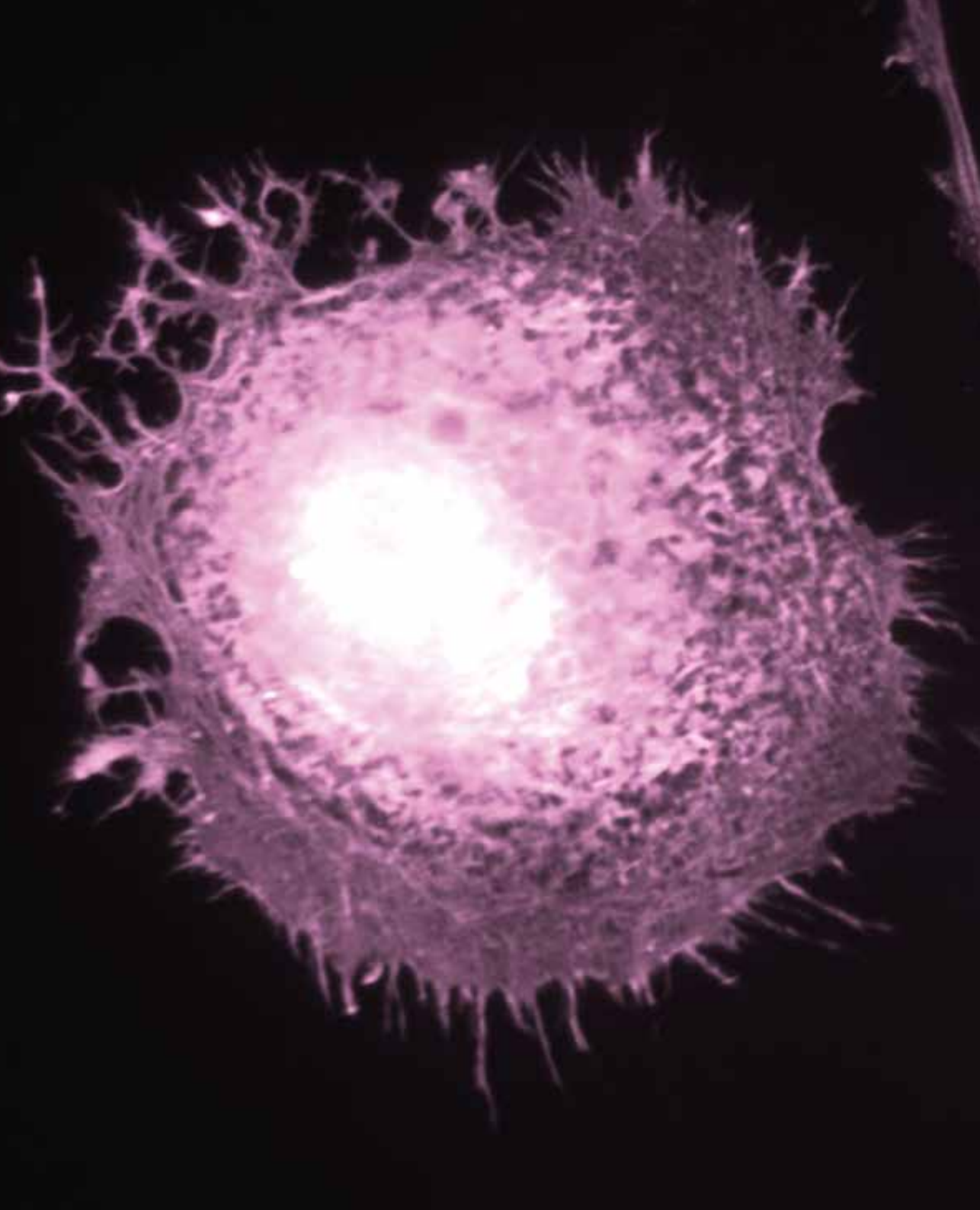
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YEAR 2004

JOURNAL

Scientific Report MLS



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