



# **ASAcampus Laser Research Abstracts**



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## Effect of MLS<sup>®</sup> Laser Therapy with Different Dose Regimes for the Treatment of Experimentally Induced Tendinopathy in Sheep: Pilot Study

Iacopetti I., Perazzi A., Maniero V., Martinello T., Patruno M., Glazar M., Busetto R.

### Effect of MLS<sup>®</sup> Laser Therapy with Different Dose Regimes for the Treatment of Experimentally Induced Tendinopathy in Sheep: Pilot Study

Photomedicine and Laser Surgery, March 2015, 33(3): 154-163

**Objective:** The aim of this preliminary study was to investigate the effect of Multiwave Locked System (MLS<sup>®</sup>), 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/cm<sup>2</sup> on the left hindlimb. Group 2 received 10 treatments of MLS laser therapy at a fluence of 2.5 J/cm<sup>2</sup> 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/cm<sup>2</sup> (group 2) caused a significant decrease of vessel area.

**Conclusions:** In this study, clinical and histological evaluation demonstrated that a therapeutic dose <5 J/cm<sup>2</sup> 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.

## High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: a randomized controlled trial

Kheshie AR, Alayat MSM., Ali MME

### High-intensity versus low-level laser therapy in the treatment of patients with knee osteoarthritis: a randomized controlled trial.

Lasers Med Sci; DOI 10.1007/s10103-014-1529-0

2014

The aim of this randomized controlled study was to compare the effects of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) on pain relief and functional improvement in patients with knee osteoarthritis (KOA). A total of 53 male patients participated in this study, with a mean (SD) age of 54.6 (8.49) years. Patients were randomly assigned into three groups and treated with HILT and exercise (HILT+EX), LLLT and exercise (LLLT+EX), and placebo laser plus exercise (PL+EX) in groups 1, 2, and 3, respectively. The outcomes measured were pain level measured by visual analog scale (VAS) and knee function measured by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical analyses were performed to compare the differences between baseline and post treatment measurements. The level of statistical significance was set as P<0.05. The result showed that HILT and LLLT combined with exercise were effective treatment modalities in decreasing the VAS and WOMAC scores after 6 weeks of treatment. HILT combined with exercises was more effective than LLLT combined with exercises, and both treatment modalities were better than exercises alone in the treatment of patients with KOA.

**Efficacy of high and low level laser therapy in the treatment of Bell's palsy: A randomized double blind placebo controlled trial**

Alayat MSM, Elsodany AM, El Fiky AAR

**Efficacy of high and low level laser therapy in the treatment of Bell's palsy: A randomized double blind placebo controlled trial.**

Lasers Med Sci; DOI 10.1007/s10103-014-1529-0

2014

The aim of this randomized controlled study was to compare the effects of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) on pain relief and functional improvement in patients with knee osteoarthritis (KOA). A total of 53 male patients participated in this study, with a mean (SD) age of 54.6 (8.49) years. Patients were randomly assigned into three groups and treated with HILT and exercise (HILT+EX), LLLT and exercise (LLLT+EX), and placebo laser plus exercise (PL+EX) in groups 1, 2, and 3, respectively. The outcomes measured were pain level measured by visual analog scale (VAS) and knee function measured by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Statistical analyses were performed to compare the differences between baseline and post treatment measurements. The level of statistical significance was set as  $P < 0.05$ . The result showed that HILT and LLLT combined with exercise were effective treatment modalities in decreasing the VAS and WOMAC scores after 6 weeks of treatment. HILT combined with exercises was more effective than LLLT combined with exercises, and both treatment modalities were better than exercises alone in the treatment of patients with KOA.

**Influence of MLS laser radiation on erythrocyte membrane fluidity and secondary structure of human serum albumin**

Pasternak K., Nowacka O., Wróbel D., Pieszyński I., Bryszewska M., Kujawa J.

**Influence of MLS laser radiation on erythrocyte membrane fluidity and secondary structure of human serum albumin**

Mol Cell Biochem; 388:261–267

2014

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<sup>-2</sup> and surface energy power density 195 mW cm<sup>-2</sup> (1,000 Hz) and 230 mW cm<sup>-2</sup> (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.

### 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

Kuryliszyn-Moskal A., Kita J., Dakowicz A., Chwieško-Minarowska S., Moskal D., Kosztyła-Hojna B., Jabłońska E., Klimiuk P.A.

### **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**

Clin Rheumatol; DOI 10.1007/s10067-014-2637-8

2014

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 serum levels may be a useful marker of microvascular abnormalities in RP patients treated with MLS laser therapy.

### Treatment of Chronic Craniofacial Pain with Mphi Laser and Orthotic

Bennett C. A., Olmos S. R.

### **Treatment of Chronic Craniofacial Pain with Mphi Laser and Orthotic**

Energy for Health [13] 2014

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<sup>®</sup>) 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.

### The effect of MLS Laser Therapy in elite football players affected by muscles injuries: a controlled clinical trial

Galanti G., Stefani L., Iacchi A., Lonero L., Moretti A.

#### **The effect of MLS Laser Therapy in elite football players affected by muscles injuries: a controlled clinical trial.**

Energy for Health [10] 2013

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.

### Effect of IR laser on myoblasts: a proteomic study

Monici M., Cialdai F., Ranaldi F., Paoli P., Boscaro F., Moneti G., Caselli A.

#### **Effect of IR laser on myoblasts: a proteomic study**

Molecular Biosystems, 2013

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.

### Direct and indirect photomechanical effects in cells and tissues. Perspectives of application in biotechnology and medicine

Rossi F., Pini R. and Monici M.

#### **Direct and indirect photomechanical effects in cells and tissues. Perspectives of application in biotechnology and medicine.**

In: Cell Mechanochemistry. Biological systems and factors inducing mechanical stress, such as light, pressure and gravity. Research Signpost / Transword Research Network, Trivandrum, India. pp. 285-301, 2010.



## High Intensity Laser versus Low Intensity Laser Therapy in management of postmenopausal osteoporosis

Thabet A.A.M., Mohamed M.S.E., Ali M.M.I., Helal O.F.

### High Intensity Laser versus Low Intensity Laser Therapy in management of postmenopausal osteoporosis.

Energy for Health [10] 2013

**Background:** It is estimated that 30%-50% of women will suffer an osteoporotic fracture in their lifetime. Laser therapy has a positive effect on bone regeneration and healing that is dependent on the characteristics of the light itself (eg, intensity and wavelength).

**Objective:** The aim of the present study was to compare the possible effect of High Intensity Laser Therapy (HILT) versus Low Level Laser Therapy (LLLT) on bone mineral density (BMD) of lumbar vertebrae in postmenopausal women with osteoporosis.

**Methods:** Thirty postmenopausal osteoporotic women participated in the study and were randomly divided in two groups. Group I consisted of 15 women receiving HILT, Group II consisted of 15 women receiving LLLT. Both groups have been exposed to three sessions of treatment per week for six successive weeks. Bone Mineral Density (BMD) of lumbar spine (L1.-5) was measured by Dual X-ray absorptiometry (DXA). Evaluation of lumbar BMD was performed before and after the end of the six weeks of treatment.

**Results:** Comparing mean values before and after treatment, the BMD measures showed that both groups had a statistically significant improvement after laser therapy. Comparing the two groups, the improvement showed by BMD was higher in Group I (HILT) than in Group II (LLLT).

The difference between the two groups was statistically significant ( $P > 0.05$ ).

**Conclusion:** Laser can be an effective method for the management of osteoporosis and improvement of BMD in postmenopausal women. On the basis of the findings of this study, HILT results more effective than LLLT.

## Long-term effect of high-intensity laser therapy in the treatment of patients with chronic low back pain: a randomized blinded placebo-controlled trial

Alayat MSM, Atya AM, Ali MME, Shosha TM

### Long-term effect of high-intensity laser therapy in the treatment of patients with chronic low back pain: a randomized blinded placebo-controlled trial.

Lasers Med Sci; DOI 10.1007/s10103-013-1472-5

2013

The aim of this study was to compare the effect of high-intensity laser therapy (HILT), alone or combined with exercise, in the treatment of chronic low back pain (CLBP). A total of 72 male patients participated in this study, with a mean (SD) age of 32.81 (4.48) years. Patients were randomly assigned into three groups and treated with HILT plus exercise (HILT + EX), placebo laser plus exercise (PL + EX), and HILT alone in groups 1, 2, and 3, respectively. The outcomes measured were lumbar range of motion (ROM), pain level by visual analog scale (VAS), and functional disability by both the Roland Disability Questionnaire (RDQ) and the Modified Oswestry Disability Questionnaire (MODQ). Statistical analyses were performed to compare the differences between baseline and post-treatment measurements. The level of statistical significance was set as  $P < 0.05$ . ROM significantly increased after 4 weeks of treatment in all groups, then significantly decreased after 12 weeks of follow-up, but was still significantly more than the baseline value in groups 1 and 2. VAS, RDQ, and MODQ results showed significant decrease post-treatment in all groups, although the RDQ and MODQ results were not significantly different between groups 2 and 3. HILT combined with exercise appears to be more effective in patients with CLBP than either HLLT alone or placebo laser with exercise.



## Comparison of analgesic and anti-inflammatory effects of the classical low level laser therapy and multiwave locked system in inflammations of serous bursae

Momanu A.

### Comparison of analgesic and anti-inflammatory effects of the classical low level laser therapy and multiwave locked system in inflammations of serous bursae.

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

2013

**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).

## Physical treatment of post traumatic gonalgia by NIR laser therapy: a case report

Caruso G., Gervasi S., Salvadori D.

### Physical treatment of post traumatic gonalgia by NIR laser therapy: a case report. Energy for Health [9]

2012

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.

### Influence of Various Laser Therapy Methods on Knee Joint Pain and Function in Patients with Knee Osteoarthritis

Gworys K., Gasztych J., Puzder A., Gworys P., Kujawa J.

#### Influence of Various Laser Therapy Methods on Knee Joint Pain and Function in Patients with Knee Osteoarthritis

*Analiza wpływu różnych metod aplikacji promieniowania laserowego na dolegliwości bólowe i wydolność czynnościową stawu kolanowego w przebiegu choroby zwyrodnieniowej* Ortop Traumatol Rehabil.;14 (3): 269-77  
2012

**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.

### Comparative Evaluation of the Direct Analgesic Efficacy of Selected Physiotherapeutic Methods in Subjects with Knee Osteoarthritis. Preliminary Report

Kędzierski T., Stańczak K., Gworys K., Gasztych J., Sibiński M., Kujawa J.

#### Comparative Evaluation of the Direct Analgesic Efficacy of Selected Physiotherapeutic Methods in Subjects with Knee Osteoarthritis. Preliminary Report

*Ocena porównawcza bezpośredniej skuteczności przeciwbólowej wybranych metod fizjoterapii u osób z chorobą zwyrodnieniową stawów kolanowych. Doniesienie wstępne* Ortop Traumatol Rehabil.;14 (6):537-44  
2012

**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 synchronized 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. Synchronized 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.

### The role of physical factors in cells differentiation, tissue repair and regeneration.

Cialdai F., Monici M.

#### **The role of physical factors in cells differentiation, tissue repair and regeneration.**

Tissue Regeneration – From Basic Biology to Clinical Application. Jamie Davies Ed., Intech - Open Access Publisher, ISBN 978-953-307-876-2. March, 2012

Physical factors may induce significant biological effects, therefore they can be applied in biomedical and biotechnological fields in order to drive and modulate biological processes. It is well known that both humoral and physical factors (in particular, but not limited to the mechanical ones) are necessary for maintaining tissue homeostasis. Both biochemical and physical factors can induce the cells to reprogram their functions to adapt dynamically to the environmental conditions. It is evident, therefore, that the only way to approach functional tissue regeneration and repair is to supply combined humoral and physical stimuli in a dose- and time-dependent manner. For example, in vitro studies have shown that a biomimetic environment simulating pulsatile flow is an indispensable condition for the tissue engineering of functional trileaflet heart valves from human marrow stromal cells. Static controls show morphological alterations and weaker mechanical properties (Hoerstrup et al., 2002). Studies on the role of physical factors in tissue repair and regeneration cover a very broad field that extends from investigations aimed at deepening our understanding of the physiological mechanisms of tissue repair and regeneration to biotech advances in tissue engineering, such as development of biocompatible scaffolds, 3D cell culture systems and bioreactors, which in the future must integrate the delivery of biochemical factors with the provision of physical stimuli that are equally necessary. In this chapter, far from providing a comprehensive overview of this field of studies, we introduce some issues concerning the application of physical factors in biomedicine and biotechnology and report the results of our research on the application of various physical stimuli (gravitational and mechanical stresses, laser radiation, electromagnetic fields (EMF)) for modulating cell commitment and differentiation, cell adhesion/migration, production and assembly of extracellular matrix (ECM) components, with the final aim of understanding when and how physical stimuli can be useful for promoting tissue repair and formation of functional tissue constructs. We also briefly mention how, in past centuries, the role of physical factors in biological processes has been understood and physical stimuli have been applied for therapeutic purposes.

### MLS® laser Therapy in dogs with pressure ulcers and open wound: case reports

L. Dragone, S. Palladini, and M. Glazar.

#### **MLS® Laser Therapy in dogs with pressure ulcers and open wound: case reports.**

Energy for Health [07] 2011

The aim of this report is to describe the clinical application of MLS Laser Therapy as adjuvant therapeutic technique in combination with topical wound management for treatment of pressure ulcers and open wound in four dogs. The dogs have sustained trauma, were hospitalized in the physical therapy veterinary clinic and had wounds that had to be treated concurrently with neurologic conditions. Pressure ulcers and open wound were managed by topical wound medications and contemporaneously were irradiated twice daily with MLS pulse. The wounds were measured at the beginning of the treatment and at the end of the therapy and showed a reduction in size during the course of treatments. MLS laser therapy may be useful as adjuvant therapeutic technique for treatment of decubitus ulcers and open wounds in dogs.

### Effect of IR Laser on Myoblasts: Prospects of Application for Counteracting Microgravity-Induced Muscle Atrophy

Monici M., Cialdai F., Romano G., Corsetto P.A., Rizzo A.M., Caselli A., Ranaldi F.

**Effect of IR Laser on Myoblasts: Prospects of Application for Counteracting Microgravity-Induced Muscle Atrophy** *Microgravity Science And Technology*; 25(1):35-42  
2012

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.

### Application of MLS<sup>®</sup> laser on muscular contracture caused by functional overload in a young athlete - case report

Galanti G., Moretti A., Lo Nero L.

**Application of MLS<sup>®</sup> laser on muscular contracture caused by functional overload in a young athlete - case report.** *Energy for Health* [9]  
2012

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.

### Short-term Effects of High-Intensity Laser Therapy Versus Ultrasound Therapy in the Treatment of low back pain: A Randomized Controlled Trial

Fiore P., Panza F., Cassatella G., Russo A., Frisardi V., Solfrizzi V., Ranieri M., Di Teo L., Santamato A.  
**Short-term Effects of High-Intensity Laser Therapy Versus Ultrasound Therapy in the Treatment of low back pain: A Randomized Controlled Trial.**  
EUR J Phys Rehabil Med 2011; 47:367-73

**Background.** Low back pain (LBP) is a common musculoskeletal disorder that is highly prevalent in the general population. Management of this pathology includes numerous interventions depending on pain severity: analgesic, nonsteroidal anti-inflammatory drugs, steroid injections. However, the effect size and duration of symptom relief are limited. Physical therapy (ultrasound [US], laser therapy, manual therapy, interferential current therapy, Back School, aerobic work, therapeutic aquatic exercise acupuncture) have been reported often with mixed results. **Aim.** To evaluate the short-term effectiveness of high-intensity laser therapy (HILT) versus ultrasound (US) therapy in the treatment of LBP. **Design.** Randomized clinical trial. **Setting.** University hospital. **Populations.** Thirty patients with LBP were randomly assigned to a HILT group or a US therapy group. **Methods.** Study participants received fifteen treatment sessions of HILT or US therapy over a period of three consecutive weeks (five days/week).

### High Intensity Laser Therapy in hand osteoarthritis: a mixed protocol's proposal

Viliani T., Pasquetti P.

#### **High Intensity Laser Therapy in hand osteoarthritis: a mixed protocol's proposal.**

Energy for Health, [08] 2011

Hand osteoarthritis (HOA) is a common chronic condition involving one or more joints of the thumb and fingers. Therapeutic approach in hand osteoarthritis must consider local interventions which are useful along the course of the pathology. Laser-therapy (Low Level Laser Therapy- LLL T-) is a possible useful instrumental therapy. High Intensity Laser Therapy (HILT) seems to be more effective than LLL T in pain and disability management of some forms of osteoarthritis, due to its higher intensity and to the depth reached by the laser ray. HILT may be used also in laser-acupuncture. The aim of this study was to analyze the efficacy of HILT in patients with symptomatic HOA, using a mixed protocol, analgesic anti-inflammatory protocol plus laser-acupuncture. 18 out-patients with symptomatic HOA (II-III Kellgren-Lawrence Grading Index) were enrolled and evaluated by Australian Canadian Osteoarthritis Hand Index (AUSCAN) and Visual-Analogue Scale (VAS), before treatment (t0), after treatment (t1) and after 3 months (t2). The patients were treated with a mixed HILT protocol, analgesic plus laseracupuncture treatment (4 sessions, once a week). The patients showed a mean statistically significant improvement between t0 and t1 in AUSCAN Index and VAS, and improvement was found in 83% of the subjects (15/18). The improvement was mostly maintained at follow-up. The mixed HILT protocol showed good results in a great percentage of HOA patients, with only 4 treatment sessions. We conclude that this kind of HILT protocol could be a good proposal for pain control and for improvement of patient's quality of life.

**Randomized, controlled, clinical study to evaluate the efficacy and safety of glucosamine hydrochloride and chondroitin sulphate in combination with physical therapy**

Munarolo D., De Lazzari F., Giordan N.

**Randomized, controlled, clinical study to evaluate the efficacy and safety of glucosamine hydrochloride and chondroitin sulphate in combination with physical therapy (HIRO+kinesitherapy) versus physical therapy alone in patients suffering from osteoarthritis of the knee.**

MED SPORT 2011; 64:159-71

**Aim.** Glucosamine and chondroitin sulphate are high molecular weight polysaccharides (glycosaminoglycans), which are among the essential constituent components of articular cartilage. In vitro, glucosamine has been shown to alter the metabolism of chondrocytes and play an immunoregulatory function, an action that could reduce inflammation. Chondroitin sulphate in physiological conditions, contributes to the elasticity of cartilage and inhibits its degradation by enzymes such as elastase and hyaluronidase. The combined use of glucosamine and chondroitin sulphate could have a synergistic role in reducing the symptoms and slowing down the advance of joint damage in osteoarthritis patients. Based on these assumptions, we have studied the effectiveness and tolerance of the association of glucosamine hydrochloride and chondroitin sulphate in improving pain symptoms and joint function in patients affected by osteoarthritis of the knee. **Methods.** A single site, randomized, prospective, controlled study, was conducted for a duration of 24 weeks, to assess the safety and efficacy of taking glucosamine and chondroitin sulphate, for the treatment of knee osteoarthritis (OA). Sixty patients, with knee OA (documented by X-ray), were divided randomly into two treatment groups. In GROUP A patients were treated with a cycle of 3 weeks of laser therapy and a cycle of 24 weeks of kinesitherapy, while in GROUP B the same treatment protocol was associated with the administration of three capsules per day of the association of glucosamine hydrochloride and chondroitin sulphate.

**Efficiency of MLS<sup>®</sup> therapy in abarticular rheumatism revealed by digital thermography and visual analog scale**

Momanu A., Csapo A.

**Efficiency of MLS<sup>®</sup> therapy in abarticular rheumatism revealed by digital thermography and visual analog scale.**

Energy for Health [08] 2011

A lot of 22 patients with acute pathology soft-tissue injuries (shoulder peri-arthritis, 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.



### Effect of pulsed high intensity Nd:YAG laser in treatment of chronic diabetic foot ulcer

Ebid A.A., Thabet A.A., Helal O.F.

#### **Effect of pulsed high intensity Nd:YAG laser in treatment of chronic diabetic foot ulcer.**

Energy for Health, [07] 2011

Delayed wound healing specially in diabetic ulcer is continuing challenge in rehabilitation medicine despite some recent advances in understanding of its basic principles and problems in wound healing that continue to cause significant morbidity and mortality. The aim of this study was to determine the effect of Pulsed High Intensity Nd:YAG Laser in the treatment of chronic diabetic foot ulcer (Deep Ulcer grade 2) and suggest laser protocol for wound healing. Forty patients suffering for chronic diabetic foot ulcer as a complication of diabetes mellitus, aged 40-70 years (mean age  $58.17 \pm 9.83$ ), were included. Patients were randomized for treatment in two groups. In the group A (HIL T group), twenty patients received 24 session of pulsed high intensity Nd:YAG laser according to designed protocol, 3 times per week in addition to standard medical treatment which is given for diabetic foot patients. In the group B (Standard Medical Therapy Group), twenty patients received standard medical treatment for 24 sessions, three times per week. The result of this study revealed that there was statistical significant reduction in wound surface area for group (A) after 12 and 24 sessions. The results have demonstrated the objective effect of pulsed high intensity Nd:YAG laser in treatment of chronic diabetic foot ulcer. Therefore, pulsed high intensity Nd:YAG laser is effective, innovative, non invasive, non expensive and can be used as a new trend physical therapy modality in the treatment of chronic diabetic foot ulcer.

### Effects of MLS® laser on myoblast cell line C2C12

L. Vignali, F. Cialdai and M. Monici.

#### **Effects of MLS® laser on myoblast cell line C2C12.**

Energy for Health [07] 12-18 ; 2011

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.



## Effect of IR laser on myoblasts: prospects of application for counteracting microgravity-induced muscle atrophy

M. Monici, F. Cialdai, G. Romano, A. Caselli, F. Ranaldi

### **Effect of IR laser on myoblasts: prospects of application for counteracting microgravity-induced muscle atrophy**

Biennial International Symposium of the European Low Gravity Research Association, Antwerp, September 2011

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.

## An in vitro study on tissue repair: impact of unloading on cells involved in the remodelling phase

Monici M., Cialdai F., Romano G., Fusi F., Egli M., Pezzatini S., Morbidelli L.

### **An in vitro study on tissue repair: impact of unloading on cells involved in the remodelling phase.**

Microgravity Sci. Technol., 2011, 23(4):391-401.

The number of astronauts involved in longlastingmissions and extra-vehicular activities is going to increase in the future. Consequently, the chance of injury due to traumatic events or unexpected emergency surgery will also increase and medical evacuation times to earth will be prolonged. Hence, the need to address requirements for surgery and trauma care in non terrestrial environments will be a priority. Tissue repair in weightlessness should therefore be regarded as a major issue not enough studied to date. Wound healing is a complex multi-step process, crucial to the survival of the organism. It starts with an inflammatory phase followed by a remodelling phase. During repair, the extracellular matrix (ECM) is sequentially remodelled by the concerted action of different cell types, in order to rebuild a functional tissue. The available literature concerning wound healing with mechanical unloading presents controversial results. However, many studies indicate impairment of the healing processes. Here we present a study on the behaviour of cells involved in the remodelling phase of repair, e.g. fibroblasts and endothelial cells, in response to microgravity ( $\mu g$ ). In particular, their adhesion/migration, cytoskeleton organization, production of ECM molecules and receptors have been investigated. Cell response to pulsed Nd:YAG laser irradiation has also been investigated in order to evaluate the possibility to use laser irradiation for counteracting the effect of  $\mu g$  on wound healing. In  $\mu g$ , we observed alterations in production/assembly of ECM molecules. Increased fibronectin (FN) and laminin (LM) could be the cause for impaired ECM rebuilding and altered cell adhesion/migration. Treatment with Nd:YAG laser pulses induced organized fibrillogenesis and favoured endothelial cell spreading and monolayer formation. These findings open the way for a better understanding of tissue repair mechanisms in space and future clinical applications on earth.

### Comparison of the effects of low energy laser and ultrasound in treatment of shoulder myofascial pain syndrome: a randomized single blinded clinical trial

Rayegani S.M., Bahrami M.H., Samadi B., Sedighpour L., Mokhtarirad M.R., Eliaspoor D.

**Comparison of the effects of low energy laser and ultrasound in treatment of shoulder myofascial pain syndrome: a randomized single blinded clinical trial.** Eur J Phys Rehabil Med; 47:391-90  
2011

**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.

### Diabetic distal symmetric polyneuropathy: Effect of low-intensity laser therapy

Khamseh M. E., Kazemikho N., Aghili R., Forough B., Lajevardi M., Dabaghian F. H., Goushegir A., Malek M.

**Diabetic distal symmetric polyneuropathy: Effect of low-intensity laser therapy.** Lasers in Medical Science; 26 (6): 831-835  
2011

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

### Thermal effects of NIR laser radiation in biological tissue:a brief survey

Fedele D., Fusi F.

#### **Thermal effects of NIR laser radiation in biological tissue:a brief survey.**

Energy for Health, [06] 2010

In this survey the laser-tissue interaction has been considered, with particular attention to thermal effects. Then Pulse Intensity Fluence formula for the hilttherapy pulse was retrieved. Thereafter PIF formula was applied with the lasers parameters used in some medical laser application to compare PIF values. In our opinion, PIF formula is easier to better understand HILT features and its differences with LLLT and Continuous Wave (CW ) Power Lasers.

### The challenge of shoulder pain

Vissarakis G., Charamidis N.

#### **The challenge of shoulder pain.**

Energy for Health, [05] 2010

Shoulder pain (SP) constitutes a major medical, social, and economic challenge. 20% of the general population will suffer SP at least once in their lifetime. Many therapeutic techniques and modalities are used to treat SP. Rehabilitation practice should utilize a problem-oriented approach to direct treatment. However numerous factors make this difficult. Consequently the patient tends to return to the clinical practice complaining about persisting symptomatology. A review of the literature has revealed lack of evidence based work for the treatment of SP. This project has been conducted to address the issue of treating non-specific SP with the use of a new modality the HILT. 31 subjects suffering non-specific SP have taken part to this project. The participants have been treated with the HILT (Nd:YAG laser Hiro 3.0) device with the standard hand piece for the pain therapy, according to a specific protocol. The Visual Analogue Scale (VAS) pain score (climax of 10) was used to evaluate the subjective pain symptomatology prior and after the treatment application. The satisfaction index has also been evaluated at the end of the therapy. The mean values  $\pm$ SD have been used for the statistical analysis. The results revealed a great reduction of the subjective pain to all individuals. The level of satisfaction was also measured very high at the end of the treatment. The study has confirmed that the Hilterapia<sup>®</sup> has shown good results regarding the improvement of SP and the level of patient satisfaction, when applied at individuals with non-specific SP.

### The HILT domain by the pulse intensity fluence (pif) formula

Fortuna D., Masotti L.

#### **The HILT domain by the pulse intensity fluence (pif) formula.**

Energy for Health [05] 2010

Laser therapy is often used to give relief in acute and chronic pain, increase the speed, quality and tensile strength of tissue repair, and improve the function of damaged neurological tissue. Treatment with laser beams is painless and causes neither a macro-chemical change nor damage in the tissue. In view of the unsatisfactory results obtained with Low Level Laser Therapy (LLLT) in deeper tissue degeneration, we studied the possible use of power laser designing a more efficient system and a new method of treating, faster and more consistently reproducible results. Specifically, LLLT can only produce either the photochemical effect or the photochemical and photo-thermal effects but not all three. Pulsed emission can be used to induce photomechanical effects. HILT principally induces photomechanical and photo-thermal by means of pulsed laser emission characterized by a particular shape of pulse. Unfortunately the formulas commonly used in the laser matter are not able to perfectly describe the HILT pulse shape and its timing and spatial distribution. The aim of our study was to define a phenomenological formula to

describe HILT pulse shape putting together both bi-three dimensional and its timing resolution. From our experimental data, collected in more of ten years, we extrapolated a mathematical common denominator able to synthesize, in just one formula (PIF), the HILT pulse features. Applying PIF formula we simulated different possible configurations for HILT, we related it with our clinical and experimental data and we defined the HILT domain in terms of antiinflammatory effect, tissue repair, tissue regeneration and toxic dose. Correlating these data with biological effects of HILT we defined the HILT domains, which are, in our opinion, useful to exactly define the biological capabilities of HILT. In our opinion, PIF formula is easier to better understand HILT features and its differences with LLLT and Continuous Wave (CW) Power Lasers.

### High intensity Laser Therapy in knee osteoarthritis: comparison between two different pulsed-laser treatment protocols

Viliani T., Martini C., Mangone G., Pasquetti P.

#### **High intensity Laser Therapy in knee osteoarthritis: comparison between two different pulsed-laser treatment protocols.**

Energy for Health [05] 2010

High Intensity Laser Therapy seems to be very effective in pain and function control in patients with KO, due to its high intensity and to the depth reached by the laser ray, but the optimal dose is not known yet. A previous research found a comparable efficacy to viscosupplementation in knee osteoarthritis II –III Kellgren stage, using the analgic –antiphlogistic protocol (10 treatment sessions of pulsed high power laser, Nd:YAG). The aim of this study was to compare the efficacy of two different HILT protocols to viscosupplementation in patients with symptomatic KO. 58 out-patients with symptomatic KO (IIII Kellgren-Lowrence Scale stage) were enrolled and evaluated by WO MAC Scales, before treatment (t0), after treatment (t1) and after 4 months (t2). After randomization, the treatment consisted in viscosupplementation (4 Hyaluronic acid Key words: knee osteoarthritis, laser therapy, High Intensity Laser Therapy, HILT infiltrations 1/week) for Group A, HILT analgic treatment (10 sessions, three times a week for Group B, 5 sessions three times a week for Group C). All the three groups showed a highly statistically significant improvement between t0 and t1 in WO MAC Scales, which was maintained at follow-up (t2). No side effect was found, neither in Group A nor in Group B, nor in Group C. HILT treatment showed analogous results to viscosupplementation. HILT seems a good medical instrument for pain control and for the improvement of patient's quality of life, with dose-related effects.

### Short-term Effects of High-Intensity Laser Therapy Versus Ultrasound Therapy in the Treatment of People With Subacromial Impingement Syndrome: A Randomized Clinical Trial

Santamato A., Solfrizzi V., Panza F., Tondi G., Frisardi V., Leggin B.G., Ranieri M., Fiore P.

#### **Short-term Effects of High-Intensity Laser Therapy Versus Ultrasound Therapy in the Treatment of People With Subacromial Impingement Syndrome: A Randomized Clinical Trial.**

Physical Therapy, 2009, Volume 89, Number 7, 643-652

Background. Subacromial impingement syndrome (SAIS) is a painful condition resulting from the entrapment of anatomical structures between the anteroinferior corner of the acromion and the greater tuberosity of the humerus. Objective. The aim of this study was to evaluate the short-term effectiveness of high-intensity laser therapy (HILT) versus ultrasound (US) therapy in the treatment of SAIS. Design. The study was designed as a randomized clinical trial. Setting. The study was conducted in a university hospital. Patients. Seventy patients with SAIS were randomly assigned to a HILT group or a US therapy group. Intervention. Study participants received 10 treatment sessions of HILT or US therapy over a period of 2 consecutive weeks. Measurements. Outcome measures were the Constant-Murley Scale (CMS), a visual analog scale (VAS), and the Simple Shoulder Test (SST).

### Clinical experience using Hilterapia in "knee arthrosis"

Sabbahi S.

#### **Clinical experience using Hilterapia® in “knee arthrosis”.**

Energy for Health [04] 2009

The aim of this study is to compare the efficacy of High Intensity Laser Therapy “HILT” against Low Level Laser Therapy “LLLT” and therapeutic ultrasound “US”, in combination with exercises, in relieving knee pain, increasing walking distance without pain and squatting in patients with knee early osteoarthritis (OA). Thirty subjects with knee early OA , males and females, age between 40 and 72 years, were enrolled. Participants were randomly and equally classified into three groups. All participants received exercise program for knee in combination with one of the therapeutic modalities compared (HILT, LLLT, US). All participants received six treatments for three weeks (twosessions/week). The results show that HILT is significantly more effective than LLLT and therapeutic US in inhibiting pain, increasing walking distance without pain and improving the ability to squat in people with knee early OA . No differences between LLLT and therapeutic US effectiveness in the treatment of early OA have been found.

### Comparison between the effects of hypergravity and photomechanical stress on cells producing ECM

Basile V., Romano G., · Fusi F. and Monici M.

#### **Comparison between the effects of hypergravity and photomechanical stress on cells producing ECM.**

Microgravity Sci. Technol., 21: 151-157, 2009. doi: 10.1007/s12217-008 -9068-6.

In the body, connective tissues have a major function in sustaining mechanical stresses. On the other hand, mechanical forces are important factors for connective tissue homeostasis. Connective tissues dynamically interact with mechanical and gravitational stimuli, changing their mechanical properties through the continuous modification of their composition, and thus improving their function. In connective tissues, mechanical forces are major regulators of extracellular matrix turnover, strongly affecting the production of extracellular matrix proteins. On the contrary, unloading conditions, such as bed rest or space flight, have a negative effect on these tissues, with loss of mass and impairment of mechanical properties. Here we describe the effect of photomechanical stress, supplied by a pulsed Nd:YAG laser, on extracellular matrix production by fibroblasts and chondrocytes, and compare it with the effect produced by hypergravity conditions. Cell morphology and structure, extracellular matrix production, cell adhesion, cell energy metabolism have been studied in treated human fibroblasts and chondrocytes by using immunocytochemistry, fluorescence and autofluorescencemicroscopy. The results show that photomechanical stress induce cytoskeleton remodelling, redistribution of membrane integrins, increase in production of ECM molecules, changes in cell energy metabolism. The effects are similar to those observed in the same cells exposed to cyclic hypergravitational stress.

### Treatment of chronic low back pain: back school versus Hilterapia

Conte P.G., Santamato A., Fiore P. Lopresto A., Mazzaracchio M.

#### **Treatment of chronic low back pain: back school versus Hilterapia.**

Energy for Health [03] 2009

Chronic low back pain can be treated with the use of back school, drugs, physical therapy with therapeutic medical equipment, psychological therapy, life style improvement and surgery. The aim of this study was to compare the efficacy of back school treatment with a combination of back school and treatment by pulsed Nd:YAG laser (Hilterapia®). Patients have been divided in two groups similar for age and sex: the first group was treated exclusively with back school exercises; conversely, the second group received a combined therapy of back school and Hilterapia®. Results obtained with the two therapy regimens have been evaluated measuring pain control and disability. Although an improvement has been observed in both groups, this was more evident in patients treated with the combined therapy.

### Effects of Hilterapia® vs. Viscosupplementation in knee osteoarthritis patients a randomized controlled clinical trial

Viliani T., Ricci E., Mangone G., Graziani C., Pasquetti P.

#### **Effects of Hilterapia® vs. Viscosupplementation in knee osteoarthritis patients a randomized controlled clinical trial.**

Energy for Health [03] 2009

Therapeutic approach in Knee Osteoarthritis (KO), a long lasting disease with both epidemiological and social implications, may consider local interventions which are useful along the course of the pathology. Viscosupplementation has got efficacy with little side effects. Lasertherapy (Low Level Laser Therapy-LLLT-) is widely used but we don't still have sure demonstrations on its efficacy. High Intensity Laser Therapy (HILT, Hilterapia®) seems to be more effective than LLLT, due to its higher intensity and to the depth reached by the laser ray. The aim of this study was to compare the efficacy of Hilterapia® to viscosupplementation in patients with symptomatic KO. 41 out-patients with symptomatic KO (II-III Kellgren-Lowrence Scale stage) were enrolled and evaluated by WOMAC and Lequesne Scales, before treatment (t0), after treatment (t1) and after 4 months (t2). After randomization, the treatment consisted in viscosupplementation (4 Hyaluronic acid infiltrations 1/week) for Group A, or Hilterapiae' (antalgic treatment, 10 sessions, three time a week) for Group B. Both the groups (A and B) showed a highly statistically significant improvement between t0 and t1 in WOMAC and Lequesne Scales. The improvement was maintained at follow-up (t2) either by Group A or Group B. No side effect was found, neither in Group A nor in Group B. Hilterapia® showed analogous results to viscosupplementation. We conclude that Hilterapia® seems a good medical instrument for pain control and for improvement of patient's quality of life.



### Hilterapia® efficiency in handling the post surgical pain after the release of the carpal tunnel

Gleiser J.

#### **Hilterapia® efficiency in handling the post surgical pain after the release of the carpal tunnel.**

Energy for Health [03] 2009

A descriptive observational study was made to evaluate the efficiency of a new option of treatment, the high power laser therapy (Hilterapia®) in handling a frequent pathology as the pain in the palm of the hand after the open release of the carpal tunnel (pillar pain). Pillar pain is a painful condition present in early stages in up to 41% of the patients after the transverse ligament release. This percentage diminishes with time, but has not yet had a therapeutic, efficient and non invasive treatment. Thirteen patients were evaluated after being operated by three different surgeons with a standard open carpal release technique. After six months of surgery, they still presented a persistent and incapacitating pain that could be attributed to a pillar pain. All patients were summated to eight sessions of Hilterapia® treatment with the HIRO 3 equipment (ASA S.r.l., Vicenza, Italy). The energy applied in the painful area of the hand was 600 Joules. Two different parameters were evaluated: pain scale and grip strength, both affected by the pathology of pillar pain. The study shows a tendency to diminish the pain and to improve the grip strength and the hand functioning. This can be attributed to the use of Hilterapia®, which opens a therapeutic way to its use in this type of condition.

### Muscle lesion in athletes: case comparison between Hilterapia and traditional therapy

Valent A.

#### **Muscle lesion in athletes: case comparison between Hilterapia and traditional therapy.**

Energy for Health [03] 2009

Muscle pathologies during sportactivities are very frequent. The most serious event is the muscle strain that needs specific treatment based upon functional rehabilitation associated with physiotherapeutic medical equipments. This clinical study compared the results obtained in two groups of 15 patients, homogeneous for pathology ( 1st degree strain), sex and age, treated with either Hilterapia® or with traditional therapy (CO<sub>2</sub> laser therapy and ultrasound therapy). Results have been evaluated by using VAS pain score, ultrasound scan, number of therapy sessions, time before sport activity can be resumed and satisfaction index of patients. Based on this study, Hilterapia® proved to be effective in reducing pain and time before sport activity can be resumed, with statistically better results when compared to conventional therapy, according to all evaluation parameters.

### Treatment of proprioceptive balance disorders: comparison between kinesitherapy and Hilterapia

Bodini G., Croce A. M.

#### **Treatment of proprioceptive balance disorders: comparison between kinesitherapy and Hilterapia**

Energy for Health [03] 2009

Proprioceptive vertigo disorders can be caused by several mechanisms, generally of muscle-tendon origin, able to induce an irritant stimulus on vestibular nuclei and on cervical sympathetic nervous system. Such disorders are often associated with pain and functional limitation of the cervical tract. Thirty subjects, subdivided in two groups, have been included in the study. One group was treated with kinesitherapy alone and the other group with kinesitherapy combined with Hilterapia®. Treatment has been administered on a daily basis for the first week and every other day for the following 2 weeks, for a total of 10 sessions. All subjects have undergone a clinical-anamnestic evaluation before treatment (T0), at the end of the first week (T1), at the end of the therapy (T2), and one month later (T3). A computerised stabilometric test, with elaboration of the cervical interference index has also been taken at T0, T2 and T3 time points. Data on semi quantitative scale have been analysed using the Mann-Whitney non parametric test. Data on cervical interference have been analysed using the parametric Paired Samples T Test. With



regards to the non parametric data, no significant variations between the two groups have emerged, However, both sets of data showed significant variations in the trend over time of the various parameters, within each group, with a more rapid improvement, in terms of pain and functional limitation, in those subjects undergoing a combined kinesiotherapy and Hilterapia<sup>®</sup> treatment. With respect to the cervical interference index, a significant variation between T0 and T3 has been observed only in the combined treatment group. Hilterapia<sup>®</sup> has been found to be an effective help to produce faster subjective improvements with kinesiotherapy and more importantly, it has been demonstrated to improve proprioceptive balance disorders.

#### Abstract. Hilterapia<sup>®</sup> and chronic ankle pain syndromes

Saggini R., Bellomo R.G., Cancelli F.

#### Abstract. Hilterapia<sup>®</sup> and chronic ankle pain syndromes.

Energy for Health [03] 2009

According to the third Newton's principle, the ground produces equal and opposite forces to those of a subject in leaning phase. Baumhauer and collaborators demonstrated that joint laxity, foot length, ankle anatomical alignment and ligaments stability are not significant risk factors for chronic ankle pain syndromes, while they registered an higher sprain incidence in subjects with muscle strength imbalance. According to Wright, once the foot has touched the ground, in a position potentially able to cause sprain, ankle pronator muscles must be able to rapidly react to prevent excessive supination and chronic pain syndromes. Freeman and collaborators hypothesized that ankle chronic traumas could damage the capsule and ligaments mechanoreceptors and concluded that the partial deafferentation of these receptors could contribute to the functional instability. In this study, a marked reduction in chronic pain symptomatology has been observed after Hilterapia<sup>®</sup> (pulsed Nd:YAG laser, mod. Hiro 3, ASA s.r.l., Vicenza, Italy) and the postural optimisation has been quantified with optoelectronic systems (Digital Biometry Images Scanning). Several scientific papers have been published about the analgesic and bio stimulating effect of Hilterapia<sup>®</sup>. Various authors have also highlighted its utility in accelerating the articular recovery process and in promoting ligament lesions healing. From our experience, we can assert that a rehabilitation protocol integrated with Hilterapia<sup>®</sup> is extremely effective, and could be considered the gold standard in the treatment of soft tissues pathology as well as in I and II degree chondropathies of the tibia-fibula-astragalus region.

#### Clinical results in treatment of gonarthrosis with HILT therapy

Valent A.

#### Clinical results in treatment of gonarthrosis with HILT therapy.

2<sup>nd</sup> Hilterapia<sup>®</sup> National Congress, 2007

**Place:** Cimone Volley, Modena **Purpose:** evaluation of the efficacy of HILT therapy in the treatment of gonarthrosis. **Method:** In this study was recruited 15 patients, affected by gonarthrosis, each patient was treated for 14 days (5 sessions during the first week, 2 sessions during the second week). HILT therapy was performed by Hiro 3.0 laser (fluence= 1430-1780 mJ/cm<sup>2</sup>, frequency= 20-30Hz; total energy= 3000J). Clinical evaluation of both functionality and pain were evaluated before and after the treatment with HILT therapy and was performed by V.A.S. scale, Womac form. Follow-up was 1 month. **Results:** after HILT therapy, 74% of patients showed an improvement of functionality and 66% of patients showed a decrease of pain. **Conclusion:** these preliminary showed that HILT therapy can be successfully used in the treatment of gonarthrosis.

### Abstract. Clinical experience using Hilterapia in knee arthrosis

Sabbahi S.A.

#### Abstract. Clinical experience using Hilterapia in “knee arthrosis”.

Energy for Health [03] 2009

Knee osteoarthritis (OA) is a common musculoskeletal disorder in Saudi population. Functional disability “like walking and squatting”, and pain are the most common complaints by OA patients. The aim of this study was to compare the efficacy of Hilterapia<sup>®</sup> against LLL and US in combination with exercises in relieving knee pain, walking distance without pain and squat in patients with knee early osteoarthritis. Thirty subjects with knee early OA, males and females, age between 40 and 72 years, were enrolled. The inclusion criterion was knee/s pain no more than two years, with clinical and radiological confirmation of the diagnosis of OA. Participants were randomly and equally classified into three groups. All participants received exercise program for knee in combination with one of the therapeutic modalities compared (Hilterapia, LLL, US). Participants at group (1) received Hilterapia<sup>®</sup>, in group (2) received LLL and in group (3) received US therapy. All participants received six treatments for three weeks (two treatments/week). In this study, a marked reduction in chronic pain symptomatology has been observed after Hilterapia<sup>®</sup> (pulsed Nd:YAG laser, mod. Hiro 3, ASA s.r.l., Vicenza, Italy) and the postural optimisation has been quantified with optoelectronic systems (Digital Biometry Images Scanning). Several scientific papers have been published about the analgesic and bio stimulating effect of Hilterapia<sup>®</sup>. Various authors have also highlighted its utility in accelerating the articular recovery process and in promoting ligament lesions healing. From our experience, we can assert that a rehabilitation protocol integrated with Hilterapia<sup>®</sup> is extremely effective, and could be considered the gold standard in the treatment of soft tissues pathology as well as in I and II degree chondropathies of the tibiafibulastragalus region. Equipments used were 3.0 HIRO (ASA S.r.l., Vicenza, Italy), Low level laser (ASA S.r.l., Vicenza, Italy) Ultrasound Unit (Zimmer Medizin System). Evaluation parameters were: perceptible pain using VAS, walking distance without pain (in meters), and squat with/without pain. Measurements were taken pre-treatment and after completion of the six sessions. The results obtained show that: Hilterapia<sup>®</sup> was more effective than LLL and therapeutic US in inhibition of pain, increasing walking distance without pain and improvement of ability to squat than LLL in people with early OA. LLL and US had some efficacy, but no differences between LLL and therapeutic US have been observed in inhibition of pain, in increase of the walking distance without pain and improvement of the ability to squat in people with early OA. Therefore, Hilterapia<sup>®</sup> in combination with exercises can be considered as an effective plan for relieving pain, and improving functions in patients with knee osteoarthritis.

### HILTherapy in the pain of bicipital long caput and/or subacromial conflict

Santamato A, Ranieri M, Ianieri G, Fiore P, Megna G.

#### HILTherapy in the pain of bicipital long caput and/or subacromial conflict.

2<sup>nd</sup> Hilterapia<sup>®</sup> National Congress, 2007

**Place:** Operative Unit and Complex Structure of Rehabilitative Physical Medicine, Foggia; Operative Unit of Rehabilitative Physical Medicine, Bari. **Purpose:** evaluation of the efficacy of HILT therapy in the pain of bicipital long caput and/or subacromial conflict. **Method:** 70 patients affected by tendinopathy were randomly divided in two groups: 35 subjects treated with HILT therapy and 35 subjects treated with ultrasound, both for the 10 sessions. All patients were examined with physical tests, Constant Murley and V.A.S. scales. **Results:** subjects treated with HILT therapy showed a better clinical-functional improvement in comparison with subjects treated with ultrasound. **Conclusion:** This study shows that the HILT therapy has anti-phlogistic and anti-edematous effects, reduces painful symptomatology so it is a valid therapeutic method for shoulder tendinopathy

**Abstract. Comparison of the clinical results of Hilterapia<sup>®</sup> and eswt in the lateral epicondylitis**  
Kang H.J., Her M.S

**Abstract. Comparison of the clinical results of Hilterapia<sup>®</sup> and eswt in the lateral epicondylitis.**  
Energy for Health [03] 2009

Lateral epicondylitis, so called tennis elbow, is the term used to describe the pain of uncertain pathogenesis that is centered over the common extensor origin, at the lateral aspect of the elbow, and that interferes with the activities of daily living, sports and work. Tennis elbow is a degenerative condition of the tendon fibers that attach on the bony prominence (epicondyle) on the outside (lateral side) of the elbow. The tendons involved are responsible for anchoring the muscles that extend or lift the wrist and hand. The aim of this study was to compare the efficacy of Hilterapia<sup>®</sup> against ESWT (Extracorporeal Shock Wave Therapy) in patients with lateral epicondylitis of the elbow. Fifty subjects, subdivided in two groups, have been included in the study. The inclusion criterion was: lateral epicondylitis with failure of at least 6 months of conservative treatment. One group was treated with Hilterapia<sup>®</sup> (9 sessions, three times a week) and the other group with ESWT (3 sessions, one/week). Results have been evaluated by using VAS (visual analog scale) and SET (simple elbow test) score at baseline and after one, three and six months. After nine months, the patient's satisfaction index has been evaluated by Roles and Maudsley score. Equipments used were HIRO 3 (ASA, S.r.l., Vicenza, Italy) and EvoTron (Switech Medical AG, Kreuzlingen, Switzerland). Each group achieved improvement at each follow up, in all parameters measured. The major improvement was achieved in both groups during the first months and continued to a lesser extent for up to six months. No significant differences between Hilterapia<sup>®</sup> and ESWT groups were detected across the different time periods in any measured parameter. This study suggests that Hilterapia<sup>®</sup> could be considered as safe, effective and noninvasive treatment modality for lateral epicondylitis. Another one attractive merit of the Hilterapia<sup>®</sup> is that patients do not have pain or side effects during the treatment and therefore the satisfaction index of patients is very high.

**Comparison between II generation cyclo-oxygenases and HILT in the treatment of backache**  
Carrara R.

**Comparison between II generation cyclo-oxygenases and HILT in the treatment of backache.**  
2<sup>nd</sup> Hilterapia<sup>®</sup> National Congress, 2007

**Place:** Consulting Room Milici, Catania **Purpose:** evaluation of the effects of HILT therapy in the treatment of human rachis affections. **Method:** 90 patients were divided in 4 groups; the different treatments were the following: 1) HILT therapy (10 sessions); 2) massage therapy (3 sessions/week); 3) cox2 therapy for 3 weeks (75mg and 90mg); 4) fisiokinesitherapy (20 days). The evaluation was based on clinical parameters and on the presence/absence of phlogistic processes. **Results:** 78% of patients treated with HILT therapy showed a decrease of painful symptomatology, while only 42% of patients treated with Cox2 therapy showed a clinical improvement. Patients treated with massage therapy and patients treated with fisiokinesitherapy showed an improvement in 75% and 62% of cases. **Conclusion:** HILT therapy can be usefully applied for pain treatment in the backache, because it is able to reach deep tissues with safety and induce a prompt decrease of the symptoms without collateral effects.

**Irradiation by pulsed Nd:YAG laser induces the production of extracellular matrix molecules by cells of the connective tissues. A tool for tissue repair**

Monici M., Basile V., Cialdai F., Romano G., Fusi F. and Conti A.

**Irradiation by pulsed Nd:YAG laser induces the production of extracellular matrix molecules by cells of the connective tissues. A tool for tissue repair.**

In: "Biophotonics: Photonic solutions for Better Health Care", J. Popp, W. Drexler, V.V. Turchin and D.L. Matthews Eds., Proc. of SPIE vol. 6991, 69912K1-10, 2008 doi: 10.1117/ 12.782865.

Many studies demonstrated that mechanical stress is a key factor for tissue homeostasis, while unloading induce loss of mass and impairment of function. Because of their physiological function, muscle, connective tissue, bone and cartilage dynamically interact with mechanical and gravitational stress, modifying their properties through the continuous modification of their composition. Indeed, it is known that mechanical stress increases the production of extracellular matrix (ECM) components by cells, but the mechanotransduction mechanisms and the optimal loading conditions required for an optimal tissue homeostasis are still unknown. Considering the importance of cell activation and ECM production in tissue regeneration, a proper use of mechanical stimulation could be a powerful tool in tissue repair and tissue engineering. Studies exploring advanced modalities for supplying mechanical stimuli are needed to increase our knowledge on mechanobiology and to develop effective clinical applications. Here we describe the effect of photomechanical stress, supplied by a pulsed Nd:YAG laser on ECM production by cells of connective tissues. Cell morphology, production of ECM molecules (collagens, fibronectin, mucopolysaccharides), cell adhesion and cell energy metabolism have been studied by using immunofluorescence and autofluorescence microscopy. The results show that photomechanical stress induces cytoskeleton remodelling, redistribution of membrane integrins, increase in production of ECM molecules. These results could be of consequence for developing clinical protocols for the treatment of connective tissue diseases by pulsed Nd:YAG laser.

**Gravitational/mechanical factors affect gene expression profile and phenotypic specification of human mesenchymal stem cells**

Monici M., Romano G., Cialdai F., Fusi F., Marziliano N., Benvenuti S., Cellai I., Egli M. and Cogoli A.

**Gravitational/mechanical factors affect gene expression profile and phenotypic specification of human mesenchymal stem cells.**

J Gravit. Physiol., 15 (1): 191-192, 2008.

Stem cell implantation is a promising approach for tissue repair. Unfortunately this possibility is strictly limited because these cells early withdraw from the cell cycle and seem to form passive, rather than active grafts. Therefore, the development of strategies capable of increasing the yield of phenotypic specification would be a primary aim in biomedical research. It is known that both biochemical and physical factors are needed for tissue homeostasis and their combination in a dose- and time-dependent manner is probably the key to *in vitro* and *in vivo* tissue regeneration. In this study, the effects of gravitational factors on human mesenchymal stem cell differentiation were investigated and compared with the ones caused by mechanical stress. The results showed that gene expression profile and phenotypic specification change according with the gravitational! mechanical stress to which the hMSCs were exposed. Loading by hyperfuge and photomechanical stress by pulsed Nd:YAG laser induced osteoblastogenesis and chondrogenesis while microgravity favoured adipogenesis.

### Treatment of chronic lumbosciatalgy: back school versus Nd:YAG laser

Conte PG, Lelli G, Lopresto A, Mazzaracchio M.

#### Treatment of chronic lumbosciatalgy: back school versus Nd:YAG laser.

2<sup>nd</sup> Hilterapia® National Congress, 2007

**Place:** Rehabilitation division, SS. Annunziata Hospital, Taranto. **Purpose:** the aim of this study is to compare the efficacy of the treatment with back school versus the combined treatment back school and laser Nd:YAG. **Method:** 14 patients, the control group (7 subjects) was treated with back school only; the other group (7 subjects) was treated with back school followed laser Nd:YAG therapy. The back school treatment was based on different physiotherapeutic exercises (e.g. stretching, Klapp posture...). The Nd:YAG laser was used at different fluences and modality, but with the same total energy (1500J). The evaluations of the results was performed by V.A.S. scale. **Results:** Both the groups of patients showed an improvement of the clinical paramenters, but the subjects treated with both therapies showed a more evident improvement, suggesting that Nd:YAG laser has a positive effect in treating lumbosciatalgy. **Conclusion:** even if the number of studied patients is small, this study showed the potentiality of HILT therapy in the treatment of chronic lumbosciatalgy.

### HILT therapy. An approach in the treatment of lumbosciatalgy

Finocchiaro S.

#### HILT therapy. An approach in the treatment of lumbosciatalgy.

2<sup>nd</sup> Hilterapia® National Congress, 2007

**Place:** Poliambulatorio della Misericordia, Pistoia **Purpose:** the aim of this work is to evaluate the efficacy of HILTherapy in the treatment of lumbosciatalgy. **Method:** 80 patients affected by lumbosciatalgy were included in this study and were divided in two group: one of the groups was treated with a protocol HILT through a CO2 laser; the other one was treated with both CO2 laser and Nd:YAG laser. The therapeutic cycle was based on 5 days of treatments for 2 weeks. Follow-up was until 60 days after the end of therapy. Patients were evaluated through V.A.S. scale. **Results:** patients treated with CO2 laser showed a slow and progressive improvement, while with both laser treatments there was quick improvement. **Conclusion:** The HILT therapy showed an early analgesic improvement, moreover this study suggest that HILT therapy induces a greater biostimulating effect.

### HILT in the treatment of patellar tendinopathy in sportsmen

Buda R., Di Caprio F, Ghermandi R, Buda M.

#### HILT in the treatment of patellar tendinopathy in sportsmen.

2<sup>nd</sup> Hilterapia® National Congress, 2007

**Place:** Institutes Rizzoli, Bologna, Poliambulatorio Life, RSM **Purpose:** to evaluate the effects of laser therapy HILT for rehabilitation of patellar tendinopathy **Method:** 20 patients were divided in two groups: in the former group there was 10 subjects treated with HILTherapy and in the latter there was 10 subjects treated with a CO2 laser. HILT therapy was performed by a pulsed laser Nd:YAG (maximum fluence = 1780J, pulse energy<120 msec; spot= 5mm); CO2 laser treatment consisted of 20W for 15 sec. . Patients were evaluated with clinical and echographic tests before, during and after the treatments. **Results:** patients of both groups showed an improvement of clinical and echographic parameters. Patients treated with HILTherapy showed an improvements of clinical parameters and produced a more quick recovery. **Conclusion:** HILT treatment is a valid therapeutic method for patellar tendinopathy.

### Percorso riabilitativo complesso nella sindrome della "spalla dolorosa" da rottura parziale e da tendinopatia calcifica della cuffia dei rotatori

Saggini R.

#### **Percorso riabilitativo complesso nella sindrome della “spalla dolorosa” da rottura parziale e da tendinopatia calcifica della cuffia dei rotatori.**

*Complex rehabilitation path of "painful shoulder" syndrome due to partial tear and calcific tendinopathy of the rotator cuff*

Sphera Medical Journal, 2007, 6:16-19

The aim of our study was to estimate the persistence of the results obtained by a complex rehabilitative approach in the treatment of partial lesions and calcific tendinopathy of the cuff rotator muscles. The aim of the study was to evaluate the therapeutic impact of a complex rehabilitative approach consisting in administering physical energy through Hilt Therapy and high energy shock waves by electrohydraulic device jointly with a protocol of joint-specific motor rehabilitation, in order to compare the two therapy for medium and long times. 40 patients were enrolled in the study. They were affected by partial lesion of the cuff rotator muscles (I or II degree) or by shoulder calcific tendonitis; the patients were clinically controlled for 360 days since the first treatment. This study proved that it is possible to codify a routine approach in the therapy of the cuff incomplete lesions of the rotator muscles by the use of different physical energy, through Hilt Therapy and high energy electrohydraulic shock waves with rapid gradient, because they allow to obtain a significant improvement of subjective and objective conditions related with pain and dysfunctional state of the shoulder, joined with rehabilitative training in the presence of a graduated physiotherapist.

### La sindrome del tunnel carpale: trattamento con HILT-Terapia

Bodini G, Croce A.M.

#### **La sindrome del tunnel carpale: trattamento con HILT-Terapia.**

Sphera Medical Journal, 2007, 5:16-20

The aim of the present study is to assess the effectiveness of HILT laser for carpal tunnel syndromes. It's a very widespread pathology that has many different etiologies. its typical symptoms are the ones of the entrapment of the median nerve at the wrist, that is to say paresthesias and pain at wrist and hand. Diagnosis is based on the clinical framework, but above all on the finding of alterations of the nerve conduction, assessed through EMG. At the present time, treatment is based on general and local medical therapy, on physical therapy and on the surgical decompression of the nerve. As far as physical therapy is concerned, there is scarce evidence about its effectiveness. In the present study, 25 patients affected by mild or medium-level carpal tunnel syndrome underwent HILT laser treatment and were assessed through clinical, echographic, and EGM tests. Assessment was performed before and after treatment, and 3 months after its end. The study shows that this physiotherapy method has a good effectiveness in the treatment of carpal tunnel syndrome.



### The Nd:YAG laser in the treatment of the osteocartilaginous lesions of the knee

Buda R., Buda M., Gigolo B., Di Caprio F., Ghermandi R., Zati A.

#### The Nd:YAG laser in the treatment of the osteocartilaginous lesions of the knee.

1<sup>st</sup> congress on Hilterapia<sup>®</sup>, 2006

**Place:** Rizzoli Institute for Orthopaedics, Bologna. **Purpose:** evaluation of the effect of the treatment with Nd:YAG laser in the osteocartilaginous lesions of the knee. **Method:** 7 patients waiting for autologous transplantation of chondrocytes for osteo-chondral lesions of the femoral condyles have been considered. 5 patients have been treated with Nd:YAG laser in between the two arthroscopic procedures, while 2 patients have not been treated. Hystologic and immunohistochemical analyses have been performed on bioptic specimens. **Results:** In comparison with control, the Nd:YAG laser treatment induced increase of growth factors in synovial fluids, decrease of inflammation factors and re-growth of jaline cartilage in a different extent depending on the age of the patients and the position of the lesions. **Conclusion:** The HILTherapy has anti-inflammatory and biostimulating effects, which have been demonstrated with histological and immunohistochemical tests, and induce the re-growth of cartilage.

### The Nd:YAG laser in the treatment of the lateral ligamental lesions of the ankle

Di Caprio F., Ghermandi R., Grandi G., Buda M., Buda R.

#### The Nd:YAG laser in the treatment of the lateral ligamental lesions of the ankle.

1<sup>st</sup> congress on Hilterapia<sup>®</sup>, 2006

**Place:** Rizzoli Institute for Orthopaedics, Bologna. **Purpose:** valuation of the effectiveness of the treatment with Nd:YAG laser in the ligamental lesions of the ankle. **Method:** 15 athletes with ligamental lesions of the ankle have been enrolled. 10 patients have been treated with Nd:YAG laser and 5 with CO2 laser. Assessment has been made by scale pain, tumefaction area and functional state of the joint before the treatment, after 1, 2, 3, 6, 12 weeks and 14 months from the treatment (follow up). **Results:** the patients treated with the Nd:YAG laser showed a very fast improvement in the pain symptoms and functional recovery with resume of the training, decrease of tumefaction area **Conclusion:** In sporting traumatology the effects induced by HILTherapy hasten the recovery time and this is particularly important in the case of agonists.

### HILT treatment in calcific tendinopathy of the shoulder. A controlled perspective study

Melegati G.

#### HILT treatment in calcific tendinopathy of the shoulder. A controlled perspective study.

1<sup>st</sup> congress on Hilterapia<sup>®</sup>, 2006

**Place:** Galeazzi Institute for Orthopaedics. **Purpose:** To compare the results obtained with different treatments on 3 groups of patients affected by calcific tendinopathy of the shoulder. **Method:** 20 patients have been divided in 3 groups: the first (A) was treated with shock waves, the second (B) was treated with kinesis therapy and the third (C) was treated with Nd:YAG laser. Assessment was made before and after the treatments by the use of the constant scale, and x-ray 6 months after the treatment. **Results:** In the B group no significant improvement of the clinical picture was observed. In A and C groups a significant improvement of the clinical picture was obtained. In the C group the best results in the post-treatment were obtained, especially in the control of the pain. **Conclusion:** both shock waves and HILTherapy improve the clinical picture in patients affected by calcific tendinopathy of the shoulder, but HILTherapy has a greater analgesic effect in comparison with shock waves.



### HILT treatment in epicondylitis

Ganzit G.P., Gurin E.

#### **HILT treatment in epicondylitis.**

1<sup>st</sup> congress on Hilterapia<sup>®</sup>, 2006

**Place:** Institute of Sport Medicine, Torino **Purpose:** to assess the efficacy of HILTherapy on pain control and functional recovery in patients affected with epicondylitis. **Method:** 23 patients (mean age 42 years) have been enrolled. They were tennis players and were affected by epicondylitis, which did not respond to other therapies. The subjects were treated with HILTherapy (10 sessions). The pain and functional state were assessed before the treatment, after 5 and 10 sessions by Steinbrocker scale, VAS and isometric strength. **Results:** pain significantly decreased after 5 sessions and was furtherly reduced after 10 sessions. Prehension strength strongly increased at the end of the therapy. **Conclusion:** The treatment with HILTherapy reduces pain and improves the functional state on patients affected by persisting epicondylitis due to sport practice.

### Treatment of low back pain caused by intervertebral disk displacement: comparison between high power laser, TENS and NSAIDs

Zati A, Fortuna D, Valent A, Pulvirenti F, Bilotta TW.

#### **Treatment of low back pain caused by intervertebral disk displacement: comparison between high power laser, TENS and NSAIDs**

Med. Sport, 2004, 57: 77-82

Low back pain is a very frequent symptom in patients affected by herniated intervertebral disk. In the majority of cases the symptomatology resolves spontaneously in some months. For this reason a conservative management is preferable to a surgical solution. There are many therapeutic possibilities but only a few, NSAIDs and TENS, have demonstrated their real efficacy. In physiotherapy, high power lasertherapy is in increasing use to treat pain due to several orthopedic diseases. In this clinical study, we have tried to assess the efficacy of high power laser therapy in low back pain caused by intervertebral disk herniation, by comparing a new laser (pulsed Nd:YAG) with the TENS and a well-known NSAIDs (Ketoprofen). This trial highlights a better result of the high power laser therapy with respect to those obtained from TENS and NSAIDs. The most striking results are represented by the longer duration of the laser effects. It is therefore to be hoped that further research will be carried out in this field.

### Cytoproliferative activity of the HILT: in vitro survey

Tarantino C., Rossi G., Flamini G., Fortuna D.

**Cytoproliferative activity of the HILT: in vitro survey.** Lasers in Medical Science; 17(4):A22  
2002

**Purpose:** to assess the stimulating capacity of the cytoproliferation of HILT Therapy in vitro. **Discussion:** HCT-8 ileocecal adenocarcinoma cells were exposed to single 7,69 J/cm<sup>2</sup> (12 sec) doses of irradiation; VERO kidney cells were treated with doses of 2.7 watt and 15 Hz for 12 sec, through Nd:YAG laser. **Method:** The assessment of cell proliferation was carried out by means of spectrophotometry, immunohistochemistry and direct cell counts. **Results:** HCT-8 cells showed an increase of cell proliferation, while in VERO cells there wasn't significant effects on proliferation. **Conclusion:** this study indicate that irradiation with Nd:YAG 1064 nm pulsed wave induces the cell proliferation in vitro and there is a direct specificity between the dosimeter and the cellular line.

### Cell growth modulation of human cells irradiated in vitro with low-level laser therapy

Squizzato F., Mognato M., Facchin F., Corti L.

#### **Cell growth modulation of human cells irradiated in vitro with low-level laser therapy.**

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

*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 ( $\lambda = 808$  nm), a pulsed wave diode ( $\lambda = 905$  nm), and a combined wave diodes ( $\lambda = 808$  nm + 905 nm), in the dose range of 1-60 J/cm<sup>2</sup>. *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.

### MLS<sup>®</sup> therapy treatment of acute shoulder pain in inflammatory processes of the rotator cuff

Smiderle C., Scapin M.

#### **MLS<sup>®</sup> therapy treatment of acute shoulder pain in inflammatory processes of the rotator cuff.**

Scientific Report MLS<sup>®</sup> - 2004

Shoulder pain is a complex pathology due to pathological processes involving the glenohumeral joint, the acromioclavicular joint, the ligaments or the supporting tendons. In this paper we illustrate the efficacy of MLS (Multiwave Locked System) Therapy in the treatment of acute shoulder pain in inflammatory processes involving the rotator cuff. Twenty patients underwent monotherapy treatment with MLS Therapy using the MIX5 system (ASA, Arcugnano, Vicenza). After an initial clinical-anamnestic examination, subjective and objective evaluations of the pain symptomatology are made right before treatment, after 10 days of application and after 30 days. At the end of MLS Therapy treatment the data are compared with each other using t-test: the results relative to the VAS ( $p < 0.0001$ ) and to the SRQ and SSRS parameters show a statistically significant improvement and, as already demonstrated previously, confirm MLS Therapy as one of the best solutions for rapidly reducing pain symptoms in many muscle-tendon diseases, guaranteeing longlasting benefits from the results.

### MLS<sup>®</sup> therapy treatment of various osteo/muscular/tendinous pathologies

Tasca A.

#### **MLS<sup>®</sup> therapy treatment of various osteo/muscular/tendinous pathologies.**

Scientific Report MLS<sup>®</sup> - 2004

Some osteo/muscular/tendinous pathologies are a source of considerable social costs due to their incidence amongst the population and their debilitating symptoms. The extent of the phenomenon and its consequent economic impact increase with the prevalence of the pathology, especially in the workplace. In order to provide a clear picture of the extent of the problem, we have provided some information regarding the incidence of some of the pathologies covered by this study.

### Clinical results in the treatment of ankle and knee distortion pathologies with MLS® therapy

Corti L., Rosa E., Norbiato V., Pedrini L.

#### **Clinical results in the treatment of ankle and knee distortion pathologies with MLS® therapy.**

Scientific Report MLS® - 2004

The aim of this study is to evaluate the effectiveness of MLS (Multiwave Locked System) Therapy on osteo-musculotendinous pathologies previously not considered, such as trauma to the knee and ankle. The knee is a complex joint, extremely exposed to trauma and degenerative lesions; while the ankle bears the body weight and is thus very vulnerable and subject to sprains. Of the 28 patients included in this study, 11 had knee trauma, 18 had ankle trauma. A 10-day treatment with the M6 system (ASA, Arcugnano, Vicenza) was scheduled, making automatic execution of the therapy possible. The VAS scores before MLS Therapy, those before therapy but after palpation, and those right after treatment are compared through t-test. The results confirm the effectiveness of MLS Therapy in the remission of painful symptoms and in recovery of functionality in a short time, so as to allow, in many cases, for the suspension of therapy before completing the 10 sessions foreseen by protocol.

### MLS® laser therapy treatment of shoulder pain: a controlled comparative study

Corti L.

#### **MLS® laser therapy treatment of shoulder pain: a controlled comparative study.**

Scientific Report MLS® - 2004

The term “periarthritis” is commonly used to describe a range of painful situations in the shoulder region, including the impingement syndrome, acute and chronic calcific tendonitis, subacromial bursitis and adhesive capsulitis. These are complex and multifactorial clinical scenarios, which cause pain and reduced mobility. These pathologies are most commonly found in classic cases where the limb is subjected to excessive strain, either during work or following intense physical activity. Periarthritis is a strain-related pathology that affects the extra rotary muscles of the upper limb (supraspinatus, infraspinatus, teres minor) or the synovial bursae (subacromial, subcoracoid and subscapular). In some athletes, the shoulder is put through considerable strain and may be subject to repeated micro traumas. In the long term, these may determine a painful syndrome that is often the cause of a suspension of sports or work activity. The pain is frequently localized on the anterior/lateral face of the shoulder, tending to spread along the front face of the arm. Following the application of pressure, a strong pain in correspondence to the bicipital groove may arise. The painful symptoms also worsen when the joint is moved. In order to understand how the different clinical scenarios develop, we need to bear in mind some important anatomical/functional aspects.

### Laserpuncture with MLS® (Multiwave Locked System) system Mphi: safety and clinical efficacy in joint disease, preliminary data

Viliani T.

#### **Laserpuncture with MLS® (Multiwave Locked System) system Mphi: safety and clinical efficacy in joint disease, preliminary data**

Energy for Health [13] 2014

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.

### Treating chronic lumbago with MLS® therapy. A controlled trial

Venturin A., Ortolani M.

### Treating chronic lumbago with MLS® therapy. A controlled trial.

Scientific Report MLS®- 2004

Lumbar pain is a symptom of variable etiology that is very widespread amongst the adult population, especially young adults in industrialized countries. Numerous epidemiological studies have been carried out over recent years, with varied findings as regards the incidence and social impact of this disease. This lack of accurate data is linked to the different sources of information, the very definition of lumbar pain, the various forms of behavior of sufferers depending on insurance systems and, finally, the different treatments used in different countries. In order to get a clear picture of the capacity of this phenomenon, it will be useful to provide some information on the prevalence of the disease, especially in the work environment, and its consequent economic impact. In Great Britain, for example, 46% of a random sample of the general population claims to have suffered from lumbago at least once in their lives. Also in Great Britain, there were 15 million medical visits for lumbago in 1993, leading to 1.5 million spinal X-rays, one million patients treated with rehabilitative physiotherapy, 100,000 hospital admissions, 30,000 day-hospital days and 24,000 surgical operations. Lumbago costs the country an estimated 520 million Euro/year.

### Low-power laser biostimulation enhances nerve repair after end-to-side neurorrhaphy: a double-blind randomized study in the rat median nerve model

Gigo Benato D, Geuna S, de Castro Rodrigues A, Tos P., Fornaro M, Boux E., Battiston B, Giacobini-Robecchi M.G.

### Low-power laser biostimulation enhances nerve repair after end-to-side neurorrhaphy: a double-blind randomized study in the rat median nerve model.

Lasers in Medical Science (2004) 19: 57–65.

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.

### Conservative treatment of low back pain caused by intervertebral disk displacement: comparison among Nd:YAG laser therapy, TENS and NSAIDs

Zati A, Fortuna D, Valent A, Filippi MV, Bilotta TW.

### Conservative treatment of low back pain caused by intervertebral disk displacement: comparison among Nd:YAG laser therapy, TENS and NSAIDs.

Laser in Medical Science, 2003

**Background:** low back pain with nerve root involvement is a very frequent symptom in patients affected by herniated intervertebral disk (1,2). In many cases symptoms resolve spontaneously in 12 months (4,5). For this reason conservative management is preferred to surgery (6). There are many methods of treatment but few, NSAIDs (12,13,14) TENS (transcutaneous electrical nerve stimulation) (15,16) have proven to be efficacious. Positive results regarding the employment of power laser in laser therapy (17,18,19,20,21,22) have led us to assess the efficacy of the laser in the treatment of this disease. **Objective:** to compare the efficacy of Nd:YAG pulsed wave (pw) laser, TENS and NSAIDs in the symptomatic treatment of intervertebral disk displacement. **Materials and Methods:** 60 patients with L4-L5 or L5-S1 intervertebral disk displacement affected by subacute back pain with nerve root involvement were divided into 3 groups. Each group underwent one of the following types of treatment for 15 days: NSAIDs (Ketoprofene), TENS or Nd:YAG laser. The assessment of the pain was carried out using two scales: Backill and VAS. Follow-up examinations were carried out 15 (T/1), 45 (T/2), and 180 (T/3) days from the beginning of treatment. **Results:** at the end of the therapeutic cycle (T/1) all three methods were efficacious. Instead, at the subsequent follow-ups there was a different trend among laser treatment and the other methods. In fact, the positive effect of laser lasted into T/3 (180 days) while the score of patients treated by NSAIDs and TENS returned to initial values. **Conclusions:** this trial highlights the superior results of laser therapy compared to those obtained by TENS and NSAIDs in the treatment of low back pain in patients affected by herniated intervertebral disk. The most striking results are represented by the longer duration of the laser effects. Despite its unclear biological effect, the High Power Laser Therapy (HILT) appears to be a interesting new treatment, worthy of further research.

### High Intensity Laser Therapy in experimentally induced chronic degenerative tenosynovitis in heavyline chicken broiler

Fortuna D., Rossi G., Bilotta T.W., Zati A., Gazzotti V., Venturini A., Pinna S., Serra C., Masotti L.

### High Intensity Laser Therapy in experimentally induced chronic degenerative tenosynovitis in heavyline chicken broiler. Proceedings of Spie; 4903:85-91

2002

**Purpose:** to assess the efficacy of HILT Therapy in tenosynovitis. **Discussion:** It is interesting to notice that the laser treatment opposes the degeneration process, stimulates the proliferation of synoviocytes and production of synovial fluid. Moreover the absolute safety of HILT on the delicate tenovaginalis structures is assessed. **Methods:** The study considered 18 chickens affected by chronic degenerative tenosynovitis experimentally induced. They were treated with pulsed Nd:YAG laser (total energy 270 Joules) for two weeks and then histological analysis was performed on the tendons. **Results:** Histology revealed reduction of the mineralization of the “choral” matrix, anti-inflammatory effect of the laser, hyperplasia of the synoviocytes and ectasia of the lymphatic vessels. **Conclusion:** the power laser (HILT) is able to exert an anti-inflammatory effect and in the course of degenerative chronic tenitis it can reduce or fully arrest the evolution of any tissue mineralization.

### The Nd:YAG pulsed wave laser as support therapy in the treatment of teno-desmopathies of athlete horses: a clinical and an experimental trial

Fortuna D., Rossi G., Paolini C., Magi A., Losani F., Fallaci S., Pacini F., Porciani C., Sandler A., Dalla Torre R., Pinna S., Venturini A.

**The Nd:YAG pulsed wave laser as support therapy in the treatment of teno-desmopathies of athlete horses: a clinical and an experimental trial.** Proceedings of Spie; 4903:105-118  
2002

**Purpose:** to assess the efficacy of HILT Therapy in the treatment of tenodesmopathies of athlete horses. **Discussion:** the clinical investigation was performed on 79 sport horses though randomized double-blind. All animals (control and treated with HILT therapy) received, on the subskin above the tendon lesion, the same local infiltration of immunostimulant. **Method:** The protocol included a clinical examination and surgical preparation for intratendineous inoculation of immunostimulant (T/0). After six days of systemic antibiotic coverage, 1064 pulsed Nd:YAG laser treatments began (T/7); three different levels of energy was applied: 110 mJ, 130 mJ, 150 mJ. **Results:** at T/2, T/3 and T/4, at one-week intervals between one another, clinical examination and ultrasonography were performed. The experimental survey showed that the Nd:YAG laser treatment was well-tolerated and safe. At T/4, in the treated subjects the best clinical improvement appeared to be gradual and continuous; ultrasonography revealed a greater ecogenicity of the treated tendon. **Conclusion:** the association between an immuno-stimulating agent and power laser considerably reduced the amount of the time necessary to obtain ultrasound resolution of the tendon and ligament lesion, as well as to antagonize the possible fibrotic evolution. In conclusion Nd:YAG laser treatment is able to reduce the “reparative phase”, but it is not able to reduce the time of the “rehabilitative phase”.

### Nd:YAG laser in experimentally induced chronic degenerative osteoarthritis in heavyline chicken broiler - pilot study

Fortuna D., Rossi G., Bilotta T.W., Zati A., Cardillo I., Venturini A., Pinna S., Serra C., Masotti L.

**Nd:YAG laser in experimentally induced chronic degenerative osteoarthritis in heavyline chicken broiler - pilot study.** Proceedings of Spie; 4903:77-84  
2002

**Purpose:** to assess the efficacy of HILT Therapy in osteoarthritis. **Discussion:** The most significant fact emerged from this study is the ability of the power laser (HILT) to antagonize the degenerative processes and to give a weak neochondrogenesis response. **Methods:** degenerative arthritis was induced in 18 chickens by intra-articular inoculation of Freund’s adjuvant. Clinical studies were carried out (weight increase and grades of lameness) as well as histological tests and seroassay (C Reactive Protein). Statistical analysis was performed by student’s paired t-test. **Results:** the control group showed severe ankylosing arthropathy, fissuration of the articular cartilage, chronic synovitis, marked deviation of the joints, abundant phlogistic infiltrate. The treated group showed circumscription of the chronic osteoarthritic process, preserved articular surface, increase in the synovial fluid, absence of necrotic fragments or phlogistic infiltrate. **Conclusion:** HILT is safe in the treatment of articular pathologies and does not induce lesions. HILT is able of antagonizing induced arthritis by anti-inflammatory effect.



### The effect of near-infrared MLS laser radiation on cell membrane structure and radical generation

Kujawa J., Pasternak K., Zavadnik I., Irzmański R., Wróbel D., Bryszewska M.

#### **The effect of near-infrared MLS laser radiation on cell membrane structure and radical generation**

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

2014

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<sup>2</sup>, spot size was 3.18 cm<sup>2</sup>) 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.

### Analgesic effects of high intensity laser therapy (hilt) for chronic hemophilic arthropathy

Demartis F., De Cristofaro R., Fasulo M.R., Boccacandro E., Cobianco A., Santagostino E.

#### **Analgesic effects of high intensity laser therapy (hilt) for chronic hemophilic arthropathy: a pilot study on safety, tolerability and clinical outcomes.**

2013

Energy for Health [11] 2013

The aim of this study was to verify analgesic effects of High Intensity Laser Therapy (HILT) for the treatment of chronic arthropathy in adult hemophilic patients and to verify its safety and tolerability. Eleven adult hemophilic patients of any degree with or without inhibitors, diagnosed with chronic arthropathy, were enrolled in this pilot open-label study by three Hemophilia Treatment Centers. All patients were treated with 3 High Intensity Laser applications/week in the symptomatic joint for 3 consecutive weeks. Clinical evaluations assessed reactions at application site and skin reactions. Outcomes were defined as variations in the Nieschi's and VAS Scores and Hemophilia Joint Health Score 2.0, compared to the baseline, as well as documented adverse events (AE5) and serious adverse events (SAEs). At the end of the study, after 3 weeks of therapy, we recorded a statistically significant decrease of Nieschi's score (-19-2.47) and VAS score (-27.1-30.66) (both at P<0.05), while no statistical difference was observed between the basal and last visit with regard to HJH-2.0 scores, Three local reactions at the site of therapy were reported, two of which were non-severe and one (paresthesia) was of moderate intensity. Three adverse events were experienced, such as transient gonalgia of the right knee that was considered to be possibly related to the study treatment. No bleeding at the site of therapy application was reported. In this pilot study, HILT demonstrated a statistically significant analgesic effect for chronic arthropathy in hemophilic adult patients: the analgesic effect was evident even after few treatment sessions and it was well tolerated with rare adverse events. Further studies have to be carried out to clarify if different doses and schedule applications could improve the clinical outcomes.



## Fields of application and effects of laser therapy in veterinary: an overview on some case reports

Rossin A.

### **Fields of application and effects of laser therapy in veterinary: an overview on some case reports**

Energy for Health [13] 2014

In recent years, the use of laser therapy has had a significant expansion in the veterinary field. Laser therapy, having achieved remarkable results in the field of human health, has also been applied to the veterinary field with equal success and its use is extending to all domestic species and even exotic animals. The situation is constantly changing, since in addition to the application of laser therapy in different therapeutic areas, it was necessary to evaluate the differences among the species in order to optimize treatment protocols. The passage from the human to the veterinary physiotherapy was the first step towards an increasing amount of applications: arthritis, neurology, dermatology and the most diverse fields of application, of course in different species, as clearly demonstrated by the case reports described by many colleagues who use almost daily laser therapy. MLS<sup>®</sup> Laser therapy has proven its effectiveness in different situations: the synergistic effect of the two wavelengths has proven a very valuable asset in counteract diseases characterized by inflammation and pain, promoting tissue repair and homeostasis. Thanks to these characteristics MLS<sup>®</sup> therapy may be applied to manage many different diseases. The laser-tissue interaction can induce photochemical, photothermal and photomechanical effects. It has been demonstrated by many studies that these effects can interfere with molecular and cellular mechanisms, thus affecting biological processes such as inflammation and pain transmission, improving the symptomatology and accelerating healing. After two/three applications, a very high percentage of patients treated for joint diseases significantly improved, as demonstrated by clinical cases found at [asaveterinary.com](http://asaveterinary.com). Moreover, in dermatology, the effect of tissue repair and regeneration, that the literature attributed, at least in part, to the laser-induced increase in ATP synthesis, in many cases shortens 30% - 40% the time required for wound healing by second intention. An interesting case report has shown promising results by applying the laser therapy to help fracture repair: improvement in the formation of bone callus, reduction of pain and inflammation have been observed, with consequent reduction in the recovery time. In the field of neurology, the conservative treatment of hernia/disc protrusion has shown a marked improvement in the patient, with reduced symptoms after 3-4 applications. Even in the field of equine excellent results have been obtained: in addition to "classical" cases with inflammatory lesions in the distal part of the limbs, it has been observed that in pathologies related to tendon injuries, there is a strong stimulation of new functional tissue formation, without abnormal scarring, which can then give rise to adhesions and functional reduction of the affected part. Furthermore, specialists in various fields and cooperating with ASA are studying protocols for exotic animals, mammals, reptiles and birds, protocols for dermatology and increasingly specific therapeutic protocols for the treatment of stomatitis / gingivitis in cats. The development of clinical protocols is the result of collaboration between specialists in different disciplines, ASA Research Division and the Joint Laboratory with the Department of Experimental and Clinical Biomedical Sciences, University of Florence, and includes the study, both in vitro and in vivo, of action mechanisms that are the basis of therapeutic effects and clinical validation of the treatment effectiveness.

## Management of chronic Achilles tendinopathy with High Intensity Laser Therapy (HILT®) and eccentric exercises

Valent A.

### **Management of chronic Achilles tendinopathy with High Intensity Laser Therapy (HILT®) and eccentric exercises**

Energy for Health [13] 2014

Achilles tendinopathies are classic pathologies due to functional overuse that mostly affect sportspeople and that are characterized by degenerative rather than inflammatory alterations. They present risk factors which can be related to intrinsic features of the subject or independent from these. Achilles tendinopathies classify in insertional tendinopathies and non insertional tendinopathies. Non insertional tendinopathies are localized in the area between 2 and 6 cm from the calcaneus insertion and they are the most frequent ones. Insertional tendinopathies are instead localized within 2 cm from the insertion and they are frequently accompanied by posterior calcaneal and/or superficial bursitis. Among the recommended treatments, the eccentric exercises present the major evidences in literature. In this clinical study we selected 20 patients affected by Achilles tendinopathy and we divided them into two homogenous groups. In group A all patients have been treated with High Intensity Laser Therapy (HILT®) combined with eccentric exercises, while in group B patients have carried out eccentric exercises combined with a HILT® placebo. From the analysis of the data obtained through pain VAS scale and functionality VISA-A scale, it emerged that both groups obtained a progressive pain decrease and functionality increase. However, the group A (HILT® + eccentric exercises) achieved statistically better results compared to group B (eccentric exercises + placebo HILT®) with a pain decrease equal to 74% against 57% and a functionality increase equal to 90% against 64%. In conclusion, our clinical study pointed out that HILT® combined with eccentric exercises is able to achieve better results in respect to eccentric exercises alone.

## The MLS® therapy in postural myofascial pain and postraumatological of the neck

Nunez G., Bertolini D., Piscopo C.

### **The MLS® therapy in postural myofascial pain and postraumatological of the neck**

Energy for Health [9] 2012

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 cervicgia. 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.

**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**

Rioja Toro J., Estévez Poy Pj, Martínez Pardo F.

**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**

*Estudio prospectivo, aleatorizado y controlado con placebo, para valorar la eficacia del tratamiento con láser, asociado o no a ortosis de muñeca en el síndrome del túnel del carpo*

*Rehabilitación (Madr)*; 46(2):92-102

2012

**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/cm<sup>2</sup> on an area of 4x4cm<sup>2</sup>. **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.

**Therapeutic approach with HILT-therapy in the pathology of the shoulder with tenosynovitis of the omeral biceps**

Saggini R., Bellomo R.G., Baldassarre V.

**Therapeutic approach with HILT-therapy in the pathology of the shoulder with tenosynovitis of the omeral biceps.**

1<sup>st</sup> congress on Hilterapia®, 2006

**Place:** Medicine and physics of rehabilitation, university of Chieti. **Purpose:** evaluation of the effectiveness of HILT therapy in the treatment of the tenosynovitis of the omeral biceps. **Method:** 30 patients were enrolled and divided in 2 groups. The former started the HILT treatment immediately after the enrollment, utilizing the latter group as control. At the end of the treatment for the former group, the latter started the therapy. Assessment was made by VAS, evaluation of joint mobility and muscle strength, echography. The treatment was made using a Nd:YAG laser. **Results:** Significant reduction or complete disappearance of the pain, reduction or complete disappearance of the edema of the tendineous sheath. **Conclusion:** HILT therapy causes the quite complete reversion of the pain symptoms together with endorphyne increase and it causes a significative decrease in the edema of the tendineous sheath. Therefore it is an effective tool in the treatment of the tenosynovitis of the omeral biceps.