Sports Injuries

Sport Injuries Can Be Successfully Managed with Low Level Laser Therapy

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Based upon the chapter from the book "Lasers in Medicine and Dentistry"
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Abstract

In the era of growing importance of sport in the life of self-confident women and men, the logical consequence is the growing incidence of sport injuries. In the search for new and more efficient treatment methods, low level laser therapy (LLLT) placed itself on a high ranked position due to its positive therapeutic results with lower rate of injury recurrence. However, it is necessary to have knowledge about the background of the injury as well as the best LLLT procedure due to be applied.

Introduction

The physical activities like light gymnastics, jogging, fitness training and even walking became an irreplaceable part in the life of modern man. People are practicing sport activities from various reasons: some to reduce their body weight or to look nicer, the other ones to cure or prevent some diseases. It has been stated that regular exercising decrease the incidence of chronic musculoskeletal disorders, cardiovascular and other systemic diseases, achieving in the end notably better quality of life. Physical activities have been integrated in daily schedule of a modern man - even fitness gyms are oftentimes open 24 hours a day. But, with more intense sports activities, more frequently are the sport injuries. Due to important psychological impact on an individual, interruption of sport activities - even if occurs only temporary - sometimes causes more damage to a person that the injury itself.

Case Report

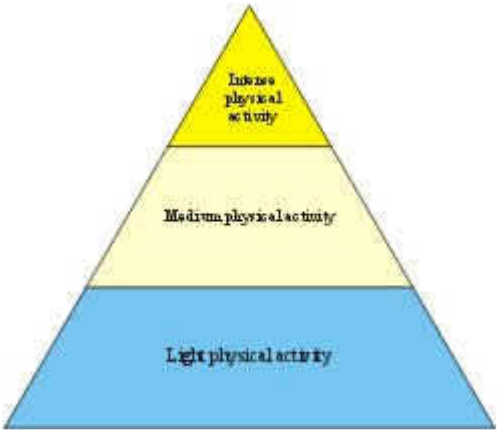
Male patient, 44 years of age, businessman, practiced bodybuilding on a daily basis, diagnosed right-sided *epicondylitis lateralis* (tennis elbow). He was forced to sustain from the bodybuilding because of painful extension and rotation of the right forearm. He completed a session of 12 classic physiotherapeutic procedures (electrotherapy, supersonic vibrations, etc.), got two corticosteriod injections in the painful site, but without significantly positive result. He was disappointed, depressed and suspicious towards new treatment modality (laser therapy) that has been recommended to him by an orthopedist. Patient refused to refrain from other physical activities except the bodybuilding. During the course of LLLT sessions, he suffered three direct mechanic traumas on the painful elbow and was forced to interrupt the treatment for 9 days due to his professional commitments. He completed 18 LLLTs, reporting pain free elbow at the end of the last treatment. Patient was advised to refrain from training for a week after the last LLLT, and to initiate the training with small weights that should be gradually increased. Five years after LLLT, patient is still pain free.

The physical activities can be divided in three main categories, according to the intensity of exercise and the risk of injury (the pyramids):

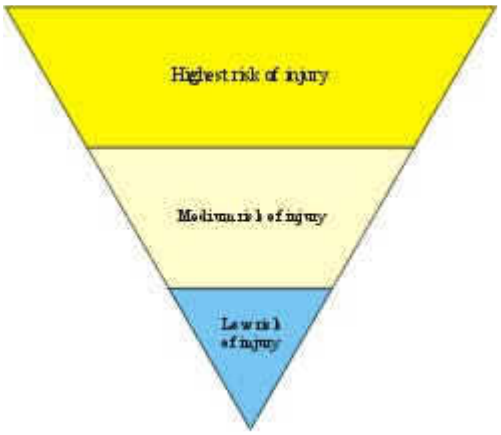
Light physical activity with the smallest risk of injury (e.g., walking, light exercises without accessories, water gymnastics) and with minimal musculoskeletal system demands.

Medium physical activity with the corresponding risk of injury. In this category the main population are the amateurs who practice sport activity regularly for a long period of time, but with medium demands for the musculoskeletal system.

Intense physical activity, with high risk of injury. It comprises professional and amateur athletes who practice sport activities due to competitive reasons. The musculoskeletal demands are maximal and sometimes at the limit, what often causes injuries and overuse syndrome.



Sports activity pyramid: Majority of the population practices light physical activity as demonstrated on the basis of the pyramid. Following the pyramidal order the top of the pyramid represents minority of the population that practices intense physical activity.



Sport injury pyramid: Those who practice intense physical activity have the highest risk of injury, while those who practice light physical activity have the lowest risk of sport injury.

The sport injury is a tissue trauma that occurs upon any type of the physical activity mentioned above. The causes of sport injuries can be intrinsic and extrinsic. Intrinsic components arise from static misbalance of the muscle system and overall biomechanical changes. Extrinsic components include inadequate sport equipment and technique as well as extended demands. Structures that are the most frequently injured during sport activities are the tendons, muscles and ligaments.

Backgrounds of sport injuries reveal:

- **Overuse**
- **Overload**
- **Incorrect technique**
- **Non-symmetric and uncoordinated muscle movements**
- **Irregular and uncontrolled training**

extremity, while the third place holds the vertebral column. The injured tissue suffers from structural damage followed by functional disability. Both processes can be reversible and irreversible, while all injuries can also be followed by bone fracture. Stress bone fractures are more frequent in female population due to their hormonal and menstrual cycle changes (amenorrhoea or anovulatory cycle). The lack of estrogen causes decrease of the bone density and bone mass in general. Women not taking hormonal anti-contraceptive pills have 20 times higher risk of a bone fracture, compared to those who take these pills. Additionally, female population is more prone to dietary nourishment, thus causing unbalanced blood levels of proteins and calcium.

Lower extremity

Injuries of the lower extremity appear the most in the specific groups of athletes like sprinters, bicycle riders, football and ice hockey players, jumpers, body builders and weight lifters as well as various types of hyperactivities. Injuries that occur are Achilles tendon injury, "jumper's knee", bursitis, *tractus iliotibialis* syndrome, *symphysis* syndrome, compartment syndrome, myogelosis, *fasciitis plantaris, calcaneodynia* and muscular scar tissue syndrome.

Upper extremity

Frequent types of sport injuries in the upper extremity are wrist and interphalangeal joints distortion, acute tendonitis of the hand, tenosynovitis of extensor and flexor muscles of the forearm, lateral and medial epicondylitis, injury of the shoulder (e.g., periarthritis humeroscapularis-PHS, acute bursitis, synovitis and partial rupture of joint capsule and *m. supraspinatus*).

Vertebral column

The most common sport injuries of the vertebral column are cervical syndrome, *torticollis*, lumbago and muscle strain.

Sport injuries represent to the athlete an unavoidable and unpleasant lay-off from training and competition with subsequent loss of form [1-3]. Consequently, there is a strong psychological impact on the athlete, especially during long-term injuries. Sport injuries of the soft tissue described above are usually treated with strong painkillers or injections of corticosteroid or analgesic drugs directly to the injured area, because the aim is to bring an athlete back to the competition as soon as possible [2, 3]. As a result of that treatment, we have observed in our clinical practice high rate of re-injuries with even higher degree of tissue damage. The reason for that is a prompt analgesic effect achieved with use of medications, but still existing damage of the tissue. Therefore, an athlete does not feel a signal telling him that tissue has been hurt (e.g., the pain) giving the best of his abilities at the sports field, while the tissue cannot support those challenges.

When affecting working population, sport injury represents an unpleasant absence from work with psychological, financial and other consequences [4]. Macroscopic changes that usually develop upon mechanic or over-loading injuries of soft tissue are in order of appearance the following: hematoma → tissue necrosis → increased tissue edema → increased pressure on the surrounding structures → decreased regenerative capability of injured area [1]. On the microscopic and pathophysiological level several changes occur: destruction of capillaries → increased interstitial aseptic inflammation → increased permeability of capillaries → increased presence of interstitial plasma proteins → decreased local blood circulation (ischaemia) → decreased local lymph circulation → increased local intensity of pain → decreased functional ability [1]. LLLT has positive influence on all stages of injury mentioned above, even when the bone fracture is involved [1-3, 5-7].

As a result, LLLT causes improvement of local blood and lymph microcirculation, induces pain relief and stimulates tissue regeneration and reparation [1-3, 5-8]. Furthermore, soft tissue trauma, regardless of its origin, is a cause for trigger points (TPs) appearance, where LLLT proved to be an effective treatment modality [6, 9].

Sport injuries should be treated urgently, not only due to the impatient sportsman, but to avoid the chronic form of the injury, which provokes irreversible structural and morphological changes making the injury much difficult to treat.

Clinical Aspects of LLLT Treatment of Sport Injuries

LLLT can be applied as monotherapy or as a complementary treatment modality. It is recommended to perform direct skin contact technique directly to the target area (i.e., irradiating directly over previously identified TPs and/or tender points) and non-contact scanning technique. When scanning technique is to be applied, the size of treated area is determined individually according to the clinical features (e.g., local status of muscle spasm, edema, induced pain, hematoma, etc.).

All patients should postponed to passive movements simultaneously with the treatment, while it was allowed to patients to gradually introduce active exercise when injury was healed enough to prevent further damage (e.g., approximately 75% of reduction in all clinical features).

Energy density	Max. energy density with TPs technique	Max. energy density with scanning	Treatments per week	Number of total LLLTs

LLLT of sport injuries causes efficient pain relief, improves wound healing when applied on surgically treated sport injuries, and reduces inflammation, what leads to better functional recovery and improved competition performance in significantly reduced period of time.

Those effects are achieved through improved local microcirculation and, thus, decreased oedema and haematoma [14]. Decreased edema and haematoma cause additional pain relief subsequently restoring functional ability. At the same time, LLLT caused pain relief through of a variety of mechanisms (e.g., increases levels of b -endorphin in spinal liquor, increases levels of serotonin and glucocorticoids in urinary excretion, decreases release of bradykinin, histamine and acetylcholine, increases production of ATP, increases pain threshold, increases local microcirculation and lymphatic flow, etc.) [6,15,16]. As a result, we have observed that LLLT significantly accelerated decreasing of local clinical features, what caused improved functional ability.

LLLT patients initiate active exercise or gymnastics significantly earlier comparing to other non-irradiated patients. It seems that professional athletes initiate training significantly earlier than those treated with standardized physiotherapeutic procedure only. We have observed in our clinical practice that those patients experience minimal loss of physical shape, and more efficient return to the competition. On the psychological level they have demonstrated minimal loss of motivation, and were more satisfied than other patients.

Advantages of LLLT include rapid (i.e., up to half a time comparing to the non-irradiated) and efficient withdrawal of local clinical features with associated improvement in functional ability, excluded use of analgesic and anti-inflammatory drugs, no infections, no pulmonary or cardiovascular dysfunction, no risks or after effects and good toleration by patients of any age, male or female. LLLT proved to be painless, cost-effective, non-labor intensive and, in current clinical study, free of side effects.

It was observed that sex do not influence clinical results, probably due to strictly individualized therapy. However, it was proved that patients over 60 years of age have had significantly prolonged recovery period compared to their younger peers. Significantly prolonged recovery period in older patients could also be explained with reduce of local microcirculation and metabolism, poor muscles and atrophic soft tissue in general, comparing to younger population [17].

When performing a double-blind study, pain relief on the side treated with sham irradiation did not exceed 10% of the initial scoring [6,7]. These minimal results comparing to the common placebo effects from the literature, were probably due to acute trauma where psychological impact is minimized [7]. Effects of sham irradiation showed no statistically important significance in these studies Ref.

Additionally, irradiated group of patients have significantly lower rate of re-injuries, what supports the hypothesis that LLLT eliminates the injury itself not only the symptoms.

General conclusions

The sedentary life style still exists, and the lack of exercise is the problem of our time. On the other hand, the necessity for rapid and efficient return to sports' competition and professional activities makes constant pressure on medical science to find new and more effective treatment modalities of sport injuries [1-3]. The rate of success and advantages of LLLT clearly demonstrates the impact of that therapeutic procedure on further treatment of sport injuries.

As a contribution to that statement, here are some guidelines and conclusions based upon our long-term experience in the treatment of sport injuries with LLLT.

- **Positive treatment effects of LLLT depend on exactly determined, adequate and optimal, individual energy doses applied on injured tissue.**
- **Therapy has to be conducted gradually, and regularly (i.e., daily) when irradiating acute surgically or non-surgically treated sport injuries.**
- **If needed, cold compresses should be applied prior to LLLT session.**

- **Reduced or excluded use of analgesic drugs enables better concentration of an athlete.LLLT gives the possibility to athletes to return to training and competition in significantly decreased period of time comparing to those after other therapeutic procedures.**
- **Many sport clubs already use LLLT as a treatment modality of sport injuries.**
- **Reduced absence from job in working population brings a financial and psychological satisfaction for employee and employer.**
- **The efficacy and advantages of low level lasers applied as monotherapy or complementary treatment modality indicates positive clinical effects in the treatment of surgically and non-surgically treated sport injuries.**

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Soft tissue injury during sport activities and traffic accidents - treatment with low level laser therapy: A multicenter double blind, placebo controlled clinical study on 132 patients.

Simunovic Z, Trobonjaca T, Switzerland/Croatia.

132 patients were treated with lllt as a monotherapy. Indications were distortion and sprain of the ankle; lesion of the Achilles tendon; dislocation of the knee, shoulder and interfalangeal joints; wrist and cervical spine injuries and both types of epicondylitis. All patients represented acute cases. Two types of irradiation techniques were used: skin contact for trigger points (830 nm) and scanning technique (633/904) for larger surface areas. The laser group was compared to a group of patients treated with conventional therapies. In the lllt group the recovery progress was accelerated by 35-50% in 85% of the patients, as compared to the control group. More abstracts will follow.

Wound healing on animal and human body with use of low level laser therapy - treatment of operated sport and traffic accident injuries: a randomized clinical study on 74 patients with control group. **Simunovic Z, Ivankovich A D, Depolo A.**

A wound healing study on rabbits suggested that 4 J/cm2 was the optimal dose. A clinical study was performed on 74 patients suffering from injuries of soft tissue upon traffic accidents and sport activities. Two types of lasers were used: 830 nm for Trigger point treatment and a ciombined 633/904 for scanning, both applied in monotherapy. Clinical parameters studied were redness, heat, pain, swelling, itching and loss of function. Wound healing was accelerated 25-35% in the laser group compared to the control group. Pain relief and functional recovery was significantly improved in the laser group as well.