

Laser Acupuncture in the management of musculo-skeletal pain and hemophilic arthropathy: a brief analysis of theoretical basis.

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ABSTRACT

The article discusses the possibility and the potentiality of treating hemophilic arthropathy with laser acupuncture. Laser acupuncture is a modern technique to stimulate acupoints without needling. Laser acupuncture is 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 protocols. In hemophilic arthropathy it could be a good non-pharmacological treatment in the management of chronic pain.

INTRODUCTION

Hemophilia is a hereditary disease that

affects coagulation system, which causes internal or external bleeding episodes. Patients with more severe forms of hemophilia suffer severe and frequent bleeds, while patients with mild hemophilia usually suffer minor symptoms. Repeated bleeding into joints, mainly knees, elbows and ankles, which occurs after minor injuries, can lead to arthropathy ("haemophilic arthropathy"), with associated pain, loss of range of movement and loss of function. Deep internal bleeding may affect deep-muscles, leading to swelling, numbness and pain of a limb. Musculoskeletal and articular problems are therefore common manifestations of hemophilia.

Despite severe arthropathy development, such patients limit the use of analgesics due to the risk of bleeding. The orthopedic

state is correlated with the quality of life, and hemophilic arthropathy, with its load of pain and functional limitation, is an important factor of disability of the hemophilic patient (1,2). The difficulty in pharmacological treatment of joint pathology, that limits the field to a few drugs, is noticeable. Also, infiltrative intra-articular therapy, which is effective and widely used in chronic arthritis, may be difficult to perform for the risk of intra-articular bleeding. For the same reasons also kinesitherapy must be performed carefully and by expert operators.

A recent review of the European Hemophilia Therapy Standardisation Board (3) notes that evidence-based guidelines on the management of pain in hemophilic patient are not yet available, despite the fact that analgesics are prescribed in 80% of cases. As haemophilia is a potentially disabling condition, any treatment that can reduce the intake of analgesic drugs, and control pain, would be considered useful.

Acupuncture today is considered a good non-pharmacological tool in treatment and pain control in osteoarthritic disorders: the mechanisms of action are well known and studied for decades by the international scientific community (4,5). Acupuncture uses the stimulation of specific points of the body, variably based upon the situations, to obtain, through local reactions and general reaction, a lowering of pain and the thrust to healing. The most classic method of stimulation of points is, as the name says, with dry needles (particular and very thin needles). The acupuncture point was recently defined as NAU ("Neural Acupuncture Unit"), which corresponds to an anatomy set particularly dense of neuronal and neuroactive components, present in skin, muscle and connective tissue (6-7). From the viewpoint of western medicine, acupuncture is a sensory stimulation technique (through the activation of peripheral fiber A-delta and C) applied at

specific points, acupuncture points and/or trigger points, which activates the pain pathways of the SNC, causes the release of pain-relieving substances and induces a rebalancing of the muscular contractility and of the sympathetic nervous system. The WHO's documents, which became milestones in the acupuncture literature, show several pathological situations in which acupuncture is proven, that in the osteoarticular field mainly concern headache, knee pain, back pain, cervicgia, epicondylitis, shoulder pain, and rheumatoid arthritis (8.9).

Acupuncture and hemophilia.

In the archives of Pubmed only 3 articles are recoverable that deal with the topic of acupuncture in hemophilia (10,11,12). In the study of Lambing (2012) nine subjects participated: six of the nine subjects reported an improvement in pain scores by at least 50%, no one of the subjects experienced bleeding, and Authors conclude that acupuncture therapy can be a safe additional modality for pain management therapies in persons with hemophilia. Wallny and Co. (2006) applied acupuncture in twelve hemophilic subjects, and ten of 12 patients showed an improvement of their pain perception, without side effects. Rosted (2002) presented a case report of an hemophilic patient with pains due to arthropathy, successfully treated with acupuncture. Even if very preliminary, these works show the effectiveness of acupuncture on pain from hemophilic arthropathy, together with the absence of side effects.

In a recent review (26) Young et CoA. underline that despite being a pervasive problem, chronic pain is suboptimally treated in subjects with hemophilia and propose a multimodal approach, which includes non-pharmacological interventions, including complementary treatments.

The need for the use of needles makes however acupuncture potentially harmful in hemophilic subjects, even if the risk of bleeding seems to be minimal.

Laser acupuncture.

Actually, to stimulate the acupoints the risk of bleeding could be entirely eliminated: in fact it is known that the acupuncture points also react to types of stimulation different from the needle. A form of modern stimulation, which could be alternative to the classic treatment with needles, is Laser-acupuncture (13), which consists in the treatment of acupuncture points with a laser light beam. The laser acupuncture is defined as "stimulation of the traditional acupuncture points with laser irradiation at low intensity, which does not induce heat". The generated light ray is directly applied on the skin at the site of acupuncture points and/or trigger points (ASHI points). The points for laser treatment are selected using the same rules for the selection of classical acupuncture. The scientific literature on laser acupuncture is broad enough even if not conclusive, and it is not yet clear whether there are differences between laser and acupuncture or not (14-20). The stimulation of acupuncture points with laser beam seems to produce similar effects to the classical acupuncture, both at clinical and neuro-molecular level. The effects of laser acupuncture are in part attributable to the peripheral nerve stimulation, with modulation of afferent input on spinal neurons, and to the increase of analgesia due to endogenous opioids, through action on central mechanisms. The laser also acts at the cellular and local level, with evidence of immune processes modulation.

Some of the researches suggests that laser acupuncture can be even more effective than the classical acupuncture. In fact laser acupuncture combines the effects of acupuncture to the stimulation effects of the laser beam. The "photobiostimulation", i.e. the trigger function of specific wavelengths laser on the acupoint, can cause biochemical, electrochemical and structural changes at the cellular level, which are specific to the laser light (and not the needle), triggering

additional factors on the outcome of the disease. The most important factor of the effectiveness of the laser acupuncture is the depth of action, and the technical parameters have recently been defined (21). The power of the laser beam in laser acupuncture is between 5-500mW (laser Class IIIb), while we remember that the lasers used in surgery exceed 100W. The therapeutic effect of laserpuncture is obtained for wavelength range between 600 and 1000 nm. With the red laser (600-700 nm) there is a poor tissue penetration, so it is usable for the treatment the surface points (points Jing Well) on the tip of the fingers of the hands and feet, while the IR laser (800-1000 nm) are required for the points on the arms, legs, back, and Ashi points. A laser beam of 5-20 mW directed on the skin does not produce pain, nor heat, nor other feelings. The stimulation frequency is very low (10 Hz) and continuous or pulsed mode evoke different reactions (22). For additional treatment details see TABLE I.

TABLE I:
Possible parameters of laser acupuncture in hemophilic arthropathy.
In acupuncture the depth of acupoints differs from each other, and the necessary depth of needle insertion for each point is specified in acupuncture tests. Therefore the laser ray must change in relation to the depth of the point to stimulate: as transmission in skin varies accordingly with wavelength, use 600-700 nm laser emission for superficial points (such as Ting points) and 800-1000 nm emission for deeper point (such as trunk and limb points). Different is also the light emission modality, because continuous or pulsed modality produce different effects, hyperpolarization or depolarization of nervous fibers: according to Chinese acupuncture we recommend continuous modality to obtain "tonification" and modulated modality to obtain "dispersion". In laser acupuncture also beam diameter, which should be 2-4 mm, is very important.

Joint	Main ACUPOINTS in meridians	LASER PARAMETERS Wavelength, frequency, power	LASER PARAMETERS Dosage, treatment time
Knee	34 GB, 34 ST, 35 ST, 36 ST, 10 SP, 9 SP, Ro Ting point, Xiyuan points, ASHI points	600-1000 nm 10 Hz 5-500mW	0.2 -0.5 J/cm ² (for superficial points, i.e. Ting point) up to 4-8 J/cm ² (for deep points, i.e. trunk and limb points) Stimulation time: from 10 sec up to few minutes
Elbow	10 TB, 11TB, 11 LI, 8 SI, 3 LU, 10 LI, 5 SI, 3 SI, 4 LI, ASHI points	600-1000 nm 10 Hz 5-500mW	0.2 -0.5 J/cm ² (for superficial points, i.e. Ting point) up to 4-8 J/cm ² (for deep points, i.e. trunk and limb points) Stimulation time: from 10 sec up to few minutes
Ankle	6 SP, 3 KID, 5 KID, 5 SP, 4 KID, 41 ST, 60-62 UB, 3 LIV, ASHI POINTS	600-1000 nm 10 Hz 5-500mW	0.2 -0.5 J/cm ² (for superficial points, i.e. Ting point) up to 4-8 J/cm ² (for deep points, i.e. trunk and limb points) Stimulation time: from 10 sec up to few minutes
Shoulder	3 SI, 5TB, 10-11-13 SI, 13-14 TB, 15 LI, 21 GB or 2 LU, 14-15 LI, 5-7 LU, 10 LI, ASHI points	600-1000 nm 10 Hz 5-500mW	0.2 -0.5 J/cm ² (for superficial points, i.e. Ting point) up to 4-8 J/cm ² (for deep points, i.e. trunk and limb points) Stimulation time: from 10 sec up to few minutes

SI = Small Intestine, LIV= Liver, GB = Gall Bladder, TB= Triple Burner, LU = Lung, LI = Large Intestine, SP = Spleen, ST = Stomach, UB = Urinary Bladder, KID = Kidney.

Only recent research has begun to analyze the possibility of using the high intensity laser acupuncture to reproduce the stimulation of the needle (23).

The other treatment parameter is the treatment time on each point, which is a function of the laser power and of the type of pathology. In general, the higher the power the lower is the treatment time, more time is needed for treatment of joint pain with respect to soft tissue pain, and more time is needed in chronic than in acute conditions. The dosage is expressed in J/cm^2 (density): $1W= 1J/sec$. Knowing the type of laser we have we can calculate the time needed. To decide the dosage on the point it must also be taken into account the area of the light beam in cm^2 . In laser acupuncture is necessary to keep the tip in contact with the skin to obtain a few millimeters diameter of the beam. Acupuncture points are then treated with different dosages on the basis of the location and the depth of the point to be addressed: in the literature there are prevailing indications on $0.2-0.5 J/cm^2$ up to $4-8 J/cm^2$, with time exposure variables depending on the type of laser. The dose should always be adjusted in relation to the assessment of the pathology and the individual response. Laser acupuncture is applied in painful pathologies, acute and chronic pains, lumbago, pain in shoulder, pain from arthritis of the hip, knee, hands, feet, epicondylitis, carpal tunnel syndrome, and in general, in all fields of application of the somatic acupuncture, ear acupuncture and other acupuncture microsystems (scalp, hand). Acupoints must be chosen accordingly with meridian theory of Chinese medicine, which nevertheless includes always the so-called ASHI points, that is painful points. The use of laser acupuncture has grown considerably in recent years due to its painless nature and to the absence of side effects. Laser Therapy is considered a safe and not dangerous tool, even in hemophilic subjects (24), reserve the operator best-practice.

Laser acupuncture and hemophilia.

Acupuncture, and consequently the laser acupuncture, is a very individualized therapy and, in order to maximize the results, it must be carried out by operators with specific preparation. In acupuncture is not possible to use standard protocols for each patient, however, in joints diseases some points are considered essential, and effective in general. You can then process the treatment plans for each joint, in particular for knee, shoulder, elbow, ankle. With defined protocols laser acupuncture can be easily associated with standard laser treatments, in the same sitting, allowing for greater efficiency, greater speed of action and a smaller number of sittings.

Some practical suggestions, only as example: in painful arthropathy the treatment acupoints could be the following (25): 34 GB, 34 ST, 35 ST, 36 ST, 10 KID, 9 SP, Ro Ting point, Xiyan points, for the knee; 3 SI, 5 TB, 10-11-13 SI, 13-14 TB, 15 LI, 21 GB or 2 LU, 14-15 LI, 5-7 LU, 10 LI, as local points for shoulder pain; and 6SP, 3 KID, 5 KID, 5SP, 4 KID, 41 ST, 60-62 UB, 3 LIV for ankle arthritis. For elbow arthropathy we could see acupoints as 10 TB, 11TB, 11 LI, 8 SI, LU, 10 LI, 5 SI, 3 SI, 4 LI. Never forget that acupuncture doesn't treat only local points but always adds very distal points related to the main involved meridians, in order to re-equilibrate the whole system, so that a knowledge of acupuncture theory and practice is required to obtain the maximum result.

CONCLUSIONS

Some experimental and clinical data suggests an hypothetical importance of laser therapy and laser acupuncture in the management of the arthropathy and musculoskeletal problems in hemophilic patients. This topic certainly deserves in-depth analysis, research programs and clinical validation.

Persons with haemophilia experience persistent joint pain as a result of repeated haemarthrosis; within a multimodal and

multidisciplinary approach, the use of laser therapy and specifically of laser acupuncture, could be a safe tool for the control of chronic pain in hemophilic arthropathy and for challenging the musculoskeletal deterioration, in order to improve the patient's quality of life as final purpose.

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