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Acupuncture and moxibustion as additional therapy

Focal point:

Laser therapy

- **Physical basics of the laser therapy**
- **Laser needle: A new therapy approach**
- **Placebo-Laser: New approaches for basic research**

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NEEDLES OF LIGHT

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Needles of light

- Introduction of a new method of therapy

Summary

Abstract

A new therapy with so called laser needles was introduced into scientific acupuncture in the year 2001. It is a pain-free procedure with practically no side-effects, used on multiple acupuncture points with high power density, according to traditional Chinese acupuncture, simultaneously on body, skull or ear, thus stimulating these points. The needle-equivalence has been demonstrated in clinical as well as in basic research with the help of so-called Neuromonitoring of the central nervous system. Therapy with laser needles leads in a very high percentage to a long term healing effect in various illnesses. In this paper the basic theoretical principles, the practical procedure and the new equipment are introduced. Recently we have successfully shown that by using different wavelengths and intensities an improvement of point stimulation and increase of penetration depth of the system has been achieved.

The clinical results of more than 8.000 cases of all treatment fields are summarized and the scientific basic research studies are introduced.

Keywords

Laser-needle, power density, penetration depth, simultaneous laser acupuncture, multi laser acupuncture

1. Introduction

The idea of developing laser needles for acupuncture results from an incidental acquaintance between the biochemist and medic Dr. Michael Weber (Author) and the laser physicist Dr. Detlef Schikora from the University of Paderborn in 1996.

The basic idea was to develop acupuncture treatments free from pain and side-effects by using laser technology and at the same time to create a scientifically verifiable equivalence to classical metal needles. At the same time, the new technology should allow to perform an individually aligned point programme according to TCM rules by simultaneous treatments. The laser principle with high-energy bundled beams is of course ideal for performing a therapy free from pain and side-effects. Laser acupuncture already exists for more than 20 years, but needle equivalence and simultaneous treatment where to date unknown to laser acupuncture. The classical laser acupuncture should preferably be called laser pen treatment, as this method only includes treating single points subsequently and not simultaneously and additionally with punctual energy outputs, which render an effective in-depth stimulation of the acupuncture point improbable or can only be realized via reflex mechanisms to be postulated.

In addition, the recommended short treatment periods that often undergo 1 minute, leave doubts concerning the effectiveness of this method. It is not without cause that this type of acupuncture treatment is mainly recommended for children, due to their thinner skin layers. Meanwhile, a large variety of in parts highly valuable literature and schoolbooks are existing concerning forms of laser acupuncture with numerous examples [1, 2, 3, 4, 5, 13].

All such works include the following thesis: A laser output exceeding a specific threshold would block the desired effects and thus, finally achieve the opposite effect or even damage the acupuncture points through the high-energy light. Such postulates have not supported laser acupuncture, but blocked any further development.

This has resulted in disillusionment concerning a previously promising method at the beginning of the new millennium, which can be easily seen in the stagnating number of users and the sales volume of the corresponding devices.

Due to a lack of scientific evidence the permission of laser acupuncture devices of any kind has been rejected by the FDA in the USA, in spite of the significant efforts of the manufacturers.

Many rightly refused to consider this method as a genuine acupuncture method due to the single-point treatment described above and f. e. health insurances in Germany did not integrate it in their pilot projects. Even efforts to prove the effects resulting from laser pen treatment by Neuromonitoring of the central nervous system remained dissatisfying.

The solution should consist of so-called laser needles, which should lead to a simultaneous stimulation with measurable energy supply and measurable results. To this end, the „needles“ represent the ends of light-conducting fibres that transport the beam generated in the laser diodes as so-called beam sources to the body and introduce them into the latter by means of direct contact. In this context, the term „needle“ must not be confused, as this needle is not being punctured into the body. It is just the extremely focussed beam that penetrates the body like a needle in order to ensure an adequate acupuncture stimulation. Thus, the term „laser needle acupuncture“ was born, which will subsequently only be mentioned in connection to the new method.

After four years of development, the first laserneedle system was presented at the Medica 2000 in Duesseldorf. This first fibre-optical device enabled the simultaneous treatment of 8 points with 50 mW red light lasers with a wave length of 680 nm by means of plastic fibres attached to the skin. This first system operated time-controlled with continuously irradiating laser source without the use of frequencies and output control.

The practice of Dr. Weber performed an extensive observation study including multiple clinical pictures with a focus on chronic pain disorders, which enabled the new device's certification.

The captured data resulted in the first publications on the new laserneedles [16, 18].

Numerous introductions of the new system followed, with scientific presentations of the treatment data on various national and international conventions and seminars – with increasing interest of the professional circles [15, 21]. Simultaneously, extensive clinical and scientific studies were initiated, on which further information will have to be provided below.

2. Scientific basis – some terms concerning laser physics

Unlike the diffuse light of a light bulb, the laser light is characterized by an extremely narrowly defined wave length range (monochromatics) and the parallel phase flow of the lightwaves (coherence). A difference is made between continuously irradiating laser sources

(cw = continuous wave) and pulsed irradiating lasers with varying frequencies (pw = pulse wave).

In addition to the wavelength indicated in nm and the frequency indicated in Hz, the output in Watt and the supplied energy in Joule are being measured (Table 1).

Table 1	Basics of important terms
Wavelength	Nm
Frequency	Hz (Oscillations/s)
Energy	J
Power density	W/cm ²
Energy density	J/cm ²

III.1: Relation between the power density and the output opening of the laser light applicator of a 39 mw laser (modified according to [3], P. 76).

The applied power per surface, the power density in W/cm² and the related energy density are the decisive measurands for stimulating a small area as f. e. an acupuncture point.

2.1 The important term of power density

Illustration 1 shows evidently how much the applied laser energy depends on the output surface of the applicator tip.

If one charges the diameter of the applicator tip against the power density, the exponential course of the chart becomes evident very fast.

With a diameter of the laser output tip of 2.8 mm a power density of 0.5 W/cm² is achieved. In spite of this high density, physical effects on the tissue with heating and coagulation are not to be expected, this will only be produced in ranges above 15-10 W/cm².

Thus, it becomes clear that applying a laserneedle with an output opening of only 0.5mm can increase significantly the energy performance on the point.

Therefore, the therapeutical effect does not only depend on the output of the applied laser diode: In addition to the used wavelength of the light, only the output per surface (Watt/cm²) determines the effect. This output can be substantially higher when using a laser with lower output and a small applicator surface as compared to using a significantly stronger laser with a larger applicator surface or eventually missing direct skin contact.

2.2 Changes of the laser beam in the tissue

A laser penetrating biological tissue triggers refraction, impact and diffusion effects of the penetrating photons. Therefore, metal and laserneedles can only be compared to a limited extent. The diffusion of light particles leads to a kind of photon fog that causes an enlargement of the beam in the tissue, thus limiting the penetration depth.

Additional absorption phenomena occur in the very tissue, on the one hand unspecified through pigments and on the other hand specifically with triggering biological effects.

Such limiting phenomena can be pronounced to a lesser extent, the smaller is the above-mentioned applicator surface of the laser needle directly applied to the skin.

How can these disturbing effects be minimized and positive effects be maximized?

Reflection effects can be minimized by applying directly the laser needle to the skin, while using a smaller applicator surface will reduce diffusion. The unspecified absorption of the laser light in the tissue can be reduced by slightly pressing the needle into the skin, in order to displace the tissue fluid with a minimum absorption through typical skin pigments.

2.3 Which wavelengths should be used?

The consideration concerning the optimum wavelength is based on the absorption behaviour of the tissues with regards to laser light with various wavelengths, as described in the work of the laser physicist Dr. Hans Romberg [14]. There is a so-called therapeutical gap in the tissue's absorption spectrum between 650 nm and 900 nm in the red and infrared range, in which the absorption is minimized and a maximum tissue penetration depth can be expected. This is why, f. e. green lasers in the range of 500 nm with a low penetration depth, are suitable for ear acupuncture.

2.4 Which penetration depths can be expected?

This question is difficult to answer as, in addition to the applied wavelength and the power density described above, various other parameters as f. e. tissue pigments and turgor must be considered. It is deemed as certain that an well focussed laser beam in the red light range cannot exceed a penetration depth of approximately 1-2 cm, but may reach 5 to 10 cm in the infrared range [14].

Withal the term “penetration depth“ must be defined in a different way as for a pricked needle: The diffusion phenomena described above lead naturally to a successive diminution of the beam. It would be important, to define, to which degree of diminution a therapeutical effect could still be expected.

Manufacturers of mere red light laser devices could also argue that by so-called inductive and snowball effects even at this wavelength, photons can reach a depth of 10 cm. It is just doubtful that in this case some single photons would still generate the desired therapeutical effects by stimulating the acupuncture point.

The term „half change depth“ can help us with this questions, as it indicated the depth, in which half of the laser light is absorbed (see table 2).

III. 2: Cellular effect principle of the photon stimulation (from [1], Page 29)

TABLE 2	Assumed half change depths: 0.1 mm for green, 0.3 mm for red and 3 mm for infrared light. Modified according to [14] Page 99 :		
500 mW laser at output	Green	Red	Infrared
Depth of 1 mm	0.5 mW	50 mW	250 mW
Depth of 6mm	0.0000000000000004 mW	0.0005 mW	0.8 mW

Provided that the absorption of an individual light quant per cell is considered as the minimum output, a maximum seems possible of 4 mm for green light, 1 cm for red light and 4 to 10 cm for infrared light with the half change depths as specified above.

2.5 Which biological effects of laser light occur?

General reactions on tissue:

- Decongestion
- Alleviation of pain
- Improved blood circulation
- Immune stimulation
- Repair effects on the tissue

Reaction on the cellular level

The following effect occur (III. 2):

- Increase of ATP synthesis
- Stimulation of the anti-oxidative metabolism
- Formation of singlet oxygen
- Stimulation of the mitochondrial metabolism
- Increase of protein biosynthesis
- Increase of DNA synthesis and cell renewal.

3. Further development of the laserneedle technology

In the frame of an extensive double-blind study concerning disturbances of the lumbar spine [22], a clearly limited effect of the red light laser on the deep tissue, especially on deeper points of the bladder and gallbladder meridian soon became evident.

This fact motivated Weber to patent a new system with the help of own developments and capturing extensive input from colleagues [19].

The so-called weberneedle system offers the following design:

- Basic device as a pure control device with 12 channels, thus, enabling the simultaneous treatment of up to 12 points (see ill. 3).
- Outsourcing of laser modules (diodes with drivers and fibre connection) enabling the replacement of laser modules and combination of various wavelengths.
- F. e. combination of 6 channels red 658 nm with 50 mW with 6 channels infrared 810 nm with 150 mW, infrared with 40 mW red and 120 mW infrared at the fibre's end during skin contact (loss at optical interfaces max. 20%).
- Stimulation of superficial points with red light and deeper with infrared light, but also f. e. very superficial with green light at the ear.
- Flexible adjustment of laser output from 0 to 100%, f. e. for the treatment of extremely sensitive areas (face)

III. 3: The weberneedle system

- Continuous operation (cw) and frequency operation (pw) is enabled with frequencies according to Bahr, Nogier and Reininger as well as free frequencies.
- Replacement of sensitive and susceptible to wear plastic fibres through highly elastic and virtually nonwearing glass fibres with long durability.

How high are the applied energies and can potential side-effects occur?

The overall doses of the applied energy are within a range of 20 to 30 Joule. In this range, no tissue damages are to be expected.

When considering certain basic rules that resemble to the principles of classical acupuncture, no side-effects are to be expected and never occurred in thousands of treatments.

4. Practical work with laserneedles

4.1 Does the patient feel the treatment?

Sometimes a slight Deqi feeling occurs after 2 to 10 minutes of treatment, if enough photon energy for stimulating the point has penetrated the tissue.

4.2 How are the treatment periods determined?

As described above, the recommended treatment times differ substantially from the treatment times of conventional laserpen acupuncture, where therapies are completed within seconds or minutes.

The criterion of a Deqi feeling is generally also in classical needle acupuncture as an optimum achievement of the point with the utmost effect and in this case, it is also used as a basis. As the Deqi feeling occurred on an average of 10 minutes and thus, a beginning optimum point stimulation could be assumed, the therapy was extended to 20 minutes. Extensive test over years have repeatedly shown that the utmost therapy has been obtained in this area.

The treatment time has been reduced to 10 minutes for sensitive areas, like the face and the ear, but can be according to new experiences extended gradually up to 15-20 minutes.

5. Areas of application

5.1. Body acupuncture

How are the laserneedles attached to the body? The author initially developed the following method and applied it for several years: A small silicone sleeve with a plate and covered by a perforated plaster is pushed on the laserneedle and subsequently fixed on the skin (III. 4.6).

This procedure is simple but can result in a hygienic problem in case of a frequent reuse of the sleeves.

2 new methods have been developed for improvement:

1. The laserneedles are fixed with industrial-made disposable sleeves that are equally attached with a perforated plaster or

2. The laserneedles are attached by means of a self-clamping sterilisable stainless steel sleeve and a perforated plaster. Additional stimulation current can be fed through the steel sleeves [17].
 3. A fixation with suction-cups similar to an ECG will be developed.
- III. 4: Silicone sleeve for multiple use, pushed onto the laserneedle, new disposable sleeves made from medical cardboard and reusable sleeves made from stainless steel.

5.2 Acupuncture of the ears and the head

An adjustable padded head ring is placed on the head like a crown. Up to 12 flexible coated wires carry the laserneedles, that can be attached at to the point with the help of a guiding bar, with slight pressure and without glue [20] Ill. 4,5,7)

6. Basic research

All previous basic research on laserneedle therapy has been performed by Professor Litscher (Karl Franzens-Universität Graz) by means of various neuromonitoring procedures. To this end, various procedures, like measuring the speed of the blood flow in different brain arteries with pulsed-doppler examination, the determination of the arterial oxygen saturation as well as the metabolic activity in various areas of the brain by using cerebral magnetic resonance imaging have been applied [these procedures are described at 7, 12].

In 2002 Litscher could prove for the first time an effect of the laserneedles on the blood flow rate in the aorta ophthalmica by using the pulsed-doppler method. In this context an effect of at least 50% as compared to classical needle acupuncture could be verified [11].

To date, such proof could not be provided for the laser pens known until then.

A work concerning the oxygen saturation in haemoglobin in various areas of the brain showed that laserneedles achieved virtually the same effect as needle acupuncture. The previously theoretically postulated term „needle equivalence“ could now be verified for the first time [10].

In another study started at the beginning of 2004 an enhanced activity of the seeing and smelling region under laserneedle therapy could also be evidenced in the frame of a double-blind f-MRT [8].

A summary of the various works about laserneedles can be found in the first book about laserneedle acupuncture that has been republished in 2004 [9].

7. Clinical studies

The author has performed approximately 8000 treatments with laserneedles in his own acupuncture institute between 2001 and 2004. In this context 5500 treatments were performed on orthopaedic syndromes. The remaining treatments concerned various other areas, like neurological, internal, ENT and gynaecological disorders.

The treatment maximum for orthopaedic pain syndromes resulted inevitably from the spectrum of a general medical practice.

The therapy evaluations have been established in the frame of an extensive observation study. They first served as a proof of the general effect of the laserneedle therapy and for comparing the latter to the classical acupuncture with laser needles. The laserneedles soon proved to obtain a positive effect similar to classical needles.

In addition it was evidenced that the first laserneedle (red light 680 nm) obviously had an especially beneficial effect on structures close to the surface, as f. e. the tendinites and neuritides or in the area of small finger joints. In this area, the laserneedle proved to be superior to metal needles.

Effects could also be determined for lumbar spine syndromes or deeper joint arthrosis, yet, such effects were not superior to classical metal needles.

In a clinical application observation, R. Klowersa described excellent results for the laserneedle acupuncture of umbilical colic of children, gastritis, sinusitis, allergical rhinitis and post-surgical muscle pain. Good results were also observed in birth preparation as well as for psychological fatigue (Burn-Out-Syndromes) [6].

III. 5: Treatment of child with migraine.

III. 6: Young patient with shoulder pain.

III. 7: Older Patient with migraine on the right side.

A clinical double-blind study in the surgery of Dr. Weber in cooperation with the Ruhr-Universitaet Bochum [22] showed that the red light laserneedles obviously did not exceed placebo effects with regards to lumbar spine syndromes.

About 50% of the patients showed positive results under verum as well as placebo acupuncture with laserneedles.

Therefore, infrared needles were used for the new advanced laserneedle system (weberneedles), as described above and achieved significantly better results with regards to the described syndromes.

8. Discussion and conclusion

Weber and Schikora had the idea of creating a real alternative to the classical needle acupuncture – „genuine“ acupuncture at multiple points, simultaneously without traumatism of the body, pain or side effects, by using so-called laserneedles. The positive results of the author’s first studies could meanwhile be reproduced and extended several times [6,9]. Already, we can expect that the laserneedle acupuncture will achieve the same status as classical acupuncture. The call for scientification of acupuncture has become louder during the last years.

III. 8: Treatment of smokers with laserneedles at the ear..

TABLE 3	Overview of own treatment data of various clinical pictures from 2001 to 2004	
Orthopaedics (n = 240)	Neurology / Psychology	Internal medicine
Spinal column syndromes (n = 90)	Residual paresis after apoplexia (n = 20)	Gastrointestinal disorders (n = 15)
Gonarthrosis (n = 90)	Migraine and other headache syndromes (n = 110)	AVK (n = 25)
Coxarthrosis (n = 45=	Trigeminal neuralgia (n = 8)=	Bronchial asthma (n = 12)
Rhizarthrosis (n = 20)	Tinnitus (n = 20)	Allergic diseases (n = 30)
Adhesive capsulitis (n = 50)	Depressions (n = 35)	
Lateral epicondylitis (n = 55)	Psychovegetative fatigue (n = 30)	
Tendinitis (n = 42)	Toxicomania (smokers, drugs) (n = 15)	
Fibromyalgia and PCP (n = 33)		
Morbus Bechterew (n = 15)		

N = Number of patients with 10 treatments respectively. .

Medical science needs double-blind studies. Laserneedle acupuncture is ideal for performing such studies, enabling a significant scientification in this area. This may serve to redefine the importance of acupuncture.

We are looking forward to hoping that many colleagues will contribute to the development of the laserneedle acupuncture with own works in order to assign founded importance to the laserneedle approach.

Result

With the laserneedle acupuncture, an innovative therapeutical instrument has been introduced. Simultaneous treatment opportunities of multiple points according to the TCM rules provides us with a method to compare in its process and effects to the classical needle acupuncture. Missing penetrations and lack of pain lead to high acceptance by patients. Basic research and clinical studies have already demonstrated impressive evidence for this method. Therefore, the needles of light don't only extend the therapeutical range of the acupuncture physician but can – by means of double-blind studies – also light up the complex topic of acupuncture research.

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