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Editorial

Mechanisms of Laser Acupuncture – Hypotheses and Evidence

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Abstract

Laser acupuncture, a rising complementary therapy, applies a low-intensity laser to acupuncture points, yet its underlying mechanisms remain unclear. Proposed hypotheses include modulation of cellular signaling, tissue repair, and immune modulation. Laser acupuncture may stimulate energy flow, neurotransmitter release, cellular changes, immune regulation, and neuroendocrine activity. Additionally, the biophoton theory suggests an involvement of ultra-weak photon radiation from cells. Litscher et al. explore these mechanisms through neurophysiological analysis, biochemical measurements, imaging techniques, and clinical trials. They documented subtle human brain responses following laser stimulation, potentially modulating the ascending reticular activating system. However, further research is needed to validate and expand these findings for broader clinical application of laser acupuncture.

Keywords

Traditional Chinese Medicine (TCM); acupuncture; laser acupuncture; mechanisms; hypotheses

1. Introduction

Laser acupuncture is a complementary, integrative therapy that is gaining popularity and involves the application of low-intensity level laser to acupuncture points on the body [1]. Despite its growing use, the underlying mechanisms of action remain poorly understood. Several hypotheses have been proposed to elucidate how laser acupuncture may exert its therapeutic effects, including modulation of cellular signaling pathways, promotion of tissue repair and regeneration, regulation of neurotransmitter release, and modulation of immune responses. Understanding these mechanisms is essential for optimizing the efficacy and application of laser acupuncture in clinical settings.

2. Definition of Laser Acupuncture and All Kinds of Photo Acupuncture

The definition was established by numerous experts at a world conference in Nice, France, in 2018 [2] and reads as follows: *"Photonic stimulation of acupuncture points and areas to initiate therapeutic effects similar to that of needle acupuncture and related therapies together with the benefits of PhotoBioModulation (PBM)"* [2]. The history of laser acupuncture to modern applications (Figure 1) has been well-researched and was recently published by the author [3].

Figure 1 Tradition meets innovation. Schematic image for laser acupuncture (© G. Litscher).

3. Traditional Hypotheses Regarding the Mechanisms of Laser Acupuncture

3.1 Stimulation of Energy Flow

Similar to traditional needle acupuncture, the laser beam is believed to stimulate energy pathways in the body known as meridians [4]. This could balance the body's energy flow (Qi) and should activate self-healing mechanisms.

3.2 Release of Neurotransmitters

Laser acupuncture might stimulate the release of neurotransmitters such as endorphins, serotonin, and/or other neurochemical substances that promote pain relief and relaxation [5].

3.3 Cellular Changes

The laser could influence various processes on a cellular level, such as the release of growth factors, cell proliferation, and cellular activity, leading to healing and faster regeneration processes [6].

3.4 Immune System Regulation

It is also speculated that laser acupuncture can modulate the immune system by regulating the production of immune cells and releasing inflammatory mediators, which could result in an improved immune response [7].

3.5 Neuroendocrine Regulation

The laser might also affect the activity of the endocrine system by regulating the release of hormones such as cortisol, insulin, etc., leading to better metabolic regulation and hormonal balance [8].

3.6 Biophoton Theory

Research conducted by Popp in the 1970s focused on living cells and their emission of ultra-weak photon radiation, known as biophotons [9, 10]. Popp developed susceptible cameras, called photomultipliers, to detect this radiation. His findings showed that living cells continuously emit biophotons, which differ from thermal radiation and classic bioluminescence, with wavelengths ranging from 220 nm to 800 nm. Interestingly, there is a notable increase in cellular photon radiation at the moment of cellular death. The research also suggested that needle acupuncture may initiate areas of cellular death at the puncture site, leading to an abrupt increase in biophoton radiation emitted by dying cells. These biophotonic impulses are believed to be transmitted through meridians to different body regions, triggering various biochemical reactions. Laser acupuncture, which mimics the mechanism of action of traditional needle acupuncture, utilizes biophotonic radiation to stimulate acupoints and should induce similar biochemical reactions [9, 10].

4. Hypotheses and Research Approaches Investigated by Litscher G. et al. Related to the Mechanisms of Laser Acupuncture

4.1 Analysis of Effects at Neurophysiological Level

Examine changes in neuronal activity and the functioning of the central nervous system following laser acupuncture [1, 11].

4.2 Measurement of Biochemical Changes

Investigation of the release of neurotransmitters and other biochemical substances in response to laser stimulation [12].

4.3 Imaging Techniques

Imaging techniques such as functional magnetic resonance imaging (fMRI) or near-infrared spectroscopy (NIRS) can be utilized to study changes in the brain and tissue during laser acupuncture [13, 14].

4.4 Analysis of Acupuncture Points

Assessment of specific responses of acupuncture points to laser stimulation and their correlation with clinical effects [15].

4.5 Animal Experimental Studies

Animal experimental investigations and mechanisms of laser acupuncture involve exploring the effects and underlying processes of applying laser light to animal acupuncture points [16, 17].

4.6 Clinical Efficacy Studies

Conducting randomized controlled trials to evaluate the effectiveness of laser acupuncture for various conditions and to understand the underlying mechanisms [18].

4.7 Evidence of Photosensitivity

Litscher et al. [19] documented consistent but subtle human brain responses following low-intensity laser stimulation of the Neiguan acupoint (PC6) on both sides of the human brain. These unique results emerged from a collaborative study involving the Medical University of Graz, the Karl-Franzens University of Graz, and the Graz University of Technology. In a healthy 26-year-old female volunteer, the analysis of 32-channel evoked potentials suggests that exposure to laser acupuncture stimulation at 1 Hz can influence the ascending reticular activating system [1, 19]. Conscious perception of stimuli relies on two essential systems. The first is the specific input system, which generates an evoked potential. The second is the nonspecific system known as the ascending reticular activating system (ARAS), as first explored by Moruzzi and Magoun in 1949 [20]. An analogous mechanism to what may occur in that experiment can be observed during sleep. Despite being activated, the ear can still register auditory stimuli, leading to auditory evoked potentials, even though the individual remains unaware of the stimuli. Hence, it is plausible that laser stimulation could modulate the functional structures within the ascending reticular activating system. Our explanations are in line with Walker's and Akhanjee's [21] investigations. They found that illumination of the skin above the median nerve at the wrist in humans using a low-power helium-neon laser (1 mW; 632.5 nm) generated a somatosensory evoked potential recorded at the Erb's point. This potential exhibited a latency comparable to that induced by electrical nerve stimulation. Extended exposure to the laser (20 minutes, 3.1 Hz) led to a significant decrease in the amplitude of the electrically evoked potential. Despite the absence of discernible thermal effects from the laser, these findings suggest that photochemical reactions modify neuronal activity.

However, further research is imperative to validate or challenge these initial findings from Walker and Akhanjee [21] and Litscher et al. [1, 19].

5. Conclusion

In conclusion, laser acupuncture is in most cases a painless complementary therapy to traditional needle acupuncture. The mechanisms underlying its efficacy are multifaceted and include stimulation of energy flow, release of neurotransmitters, cellular changes, immune system regulation, neuroendocrine regulation, biophoton theory, and photosensitivity. Ongoing research employs various approaches such as neurophysiological analysis, biochemical measurements, imaging techniques, assessment of acupuncture points, and clinical efficacy studies to further understand and validate the mechanisms and effectiveness of laser acupuncture. Recent studies have provided intriguing insights into the neurophysiological responses to laser acupuncture stimulation, suggesting potential modulation of the ascending reticular activating system. However, further research is needed to confirm and expand upon these findings, paving the way for a deeper understanding and broader adoption of laser acupuncture in clinical practice. Robot-assisted laser acupuncture is also no longer a future vision [22] and will help to investigate the basic mechanism.

Author Contributions

The author did all the research work for this study.

Competing Interests

The author hereby declares that no conflict of interests exists in connection with the publication of this editorial.

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