

Laser Therapy of Nail Psoriasis

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ABSTRACT

Laser therapy has proved to be a safe and effective therapy for nail plate psoriasis, alone or in combination with other therapeutic modalities, being especially beneficial with topical treatments. Laser can help to improve this resistant form of psoriasis with high patient's satisfaction [1]. A positive clinical effect of the laser is supposed to be caused by its effect on angiogenesis and vascularity within the psoriatic nail unit. Several case reports and clinical studies have been reported; however, the results are rather contradictory. While some authors claim effects mainly on nail bed psoriasis, others report more positive results on nail matrix psoriasis, or even negative effects on nail bed psoriasis [2].

LASER THEORY

Laser depends on the quantum theory that stated that one photon of an appropriate wavelength could interact with an excited atom to induce emission of a second photon. The emitted photon would have the same frequency, direction and phase of the incident photon [3].

Spontaneous and Stimulated Emission of Radiation

Most atoms exist naturally in a low energy (ground) state. Electrons in their ground state can be excited to a higher energy state when they absorb thermal, optical or electrical energy. This electron must eventually decay to a lower level, giving off a photon of radiation. This event is called "spontaneous emission," and the photon is emitted in a random direction and a random phase [4]. For stimulated emission to happen, an already excited electron has to collide with yet another photon with the proper energy leading to the emission of two photons having the same energy, frequency and direction. Such emitted photons can again stimulate the emission of further photons [5].

MECHANISM OF LASER ACTION

In stimulated emission an external power source creates excitation of the atoms in the lasing medium in a process called pumping. Population inversion is created by pumping electrical or light energy into the population of atoms (the gain medium) to move them to higher energy levels with emitting photons in random directions. A photon will pass by an atom with electrons in the upper level and cause it to emit a second photon travelling in the same direction, phase and wavelength [4].

LASER LIGHT PROPERTIES

Laser is a device based on the luminance stimulated by photons of characteristic frequency with unique features. Laser light is monochromatic (The photons emitted

are identical and the light emission contains only one wavelength), collimated rays of light are parallel (even in long distance), coherent (all the waves are in phase with one another in both time and space) and high energy [6].

LASER TISSUE INTERACTION

Lasers cause their clinical effects when light is absorbed by molecules known as chromophore. The three primary endogenous cutaneous chromophores are water, melanin, and hemoglobin. Upon absorption of laser energy by the skin, photothermal, photochemical, or photomechanical effects may occur [7]. A biological effect of laser light in the tissue can only be achieved if the light is absorbed and converted into thermal energy. This biological effect depends on the energy density, the pulse width/pulse duration and the heat conduction. It is possible to target a specific chromophore by selecting a wavelength that is absorbed by the chromophore with minimal absorption by other competing chromophores [5].

EXCIMER LASER

The excimer (308 nm) laser is already widely used for the treatment of skin psoriasis, with excellent results. Although Lasers and light devices have been shown to be effective in the treatment of psoriasis vulgaris, however the data for nails is scanty [8]. The excimer laser penetrates the nail plate to reach active disease and induces T-cell apoptosis characterized by breaks in DNA strands as well as expression of mitochondrial proteins associated with cell death [9].

PULSED DYE LASER

Pulsed dye laser (PDL) commonly used for the treatment of cutaneous vascular lesions, has been shown to be effective for the treatment of not only plaque type psoriasis but also NP [10]. Pulsed dye laser acts by selective laser ablation of dermal papillary vasculature but its action is confined to the superficial microvasculature. In addition, PDL reduces the number of T-lymphocytes on the skin, helping to control inflammation. The PDL (595 nm) at both short and long pulse duration have been used successfully to treat NP including both nail bed and matrix lesions with decrease in NAPSI score. Pain lasting up to 24 hours was the major side reported in addition to transient petechiae and hyperpigmentation [11]. Neodymium Yttrium Aluminum Garnet Laser Nd: YAG laser (1064 nm) is a solid-state laser. Its action based on the theory of selective photo thermolysis. The Nd: YAG laser energy is then converted into heat energy, resulting in destruction of the target tissue [12]. Uses of long pulsed Nd: YAG laser in dermatology Due to its high penetration and low specificity, Nd: YAG laser is widely used in dermatology [13].

➤ Hair removal

➤ vascular lesions

The Nd: YAG Laser is a well - documented treatment for vascular lesions. Long pulsed Nd: YAG lasers (5-60 msec) gave the opportunity to extend the application of this wavelength to the removal of fine telangiectasia connected with rosacea and reticular leg veins. The deep penetration depth of the Nd:YAG wavelength combined

with the pulse duration matching the thermal relaxation time of targeted vessels, could potentially allow the treatment of these vessels [14].

➤ Acne keloidalis nuchae, small keloids and hypertrophic scar ➤ Onychomycosis
Long pulsed Nd: YAG laser can be used as a safe and effective modality in the treatment of onychomycosis. It is estimated that long pulsed Nd:YAG laser can deeply penetrate the tissue and effectively inhibit fungal growth in the nail bed owing to its long wavelength [15].

THE ROLE OF ND: YAG LASER IN NAIL PSORIASIS

The long-pulsed 1,064-nm Nd:YAG laser has been recently suggested as a promising treatment option for NP. No statistically significant difference was detected in its efficacy compared to PDL [1]. (Kartal et al., [16]) also reported significant improvement in both nail bed and nail matrix lesions with reduction in NAPSI score in 16 patients after three treatment sessions.

MECHANISM OF ACTION OF ND: YAG LASER IN NAIL PSORIASIS

Angiogenesis play an important role in the pathogenesis of psoriasis. Based on selective photothermolysis, destruction of abnormal psoriatic vasculature, a major component of psoriatic dermal papillae, can be achieved upon treatment with Nd:YAG laser which has the ability to penetrate deeper into the dermis [17]. The use of Nd: YAG laser for NP seems plausible as its use for deeper vascular lesions is well established and the longer wavelength may translate into improved deep penetration into nail bed or nail matrix. The results in vascular lesions are promising because of the treatment success without adverse events with high patient satisfaction [18]. The Nd: YAG laser has been reported to improve nail bed lesions faster than nail matrix lesions because the nail bed dermis has more vascular structures than nail matrix rendering it as a more suitable target [16]. In addition to blood vessel destruction, Nd:YAG laser is thought to reduce T helper cells and CD3+ lymphocytes in the dermis and cytotoxic T cells in the epidermis, which in turn normalize epidermal proliferation and improve the clinical findings in psoriasis [16]. Side effects Side effects from Nd: YAG laser treatments in NP are usually minor including tolerable pain during treatment that can be reduced by contact cooling and if necessary, topical anesthetic [19].

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