

Laser Therapy in the Successful Treatment of Dermatological Conditions

By Paul Schwen, May 15, 2017

Recent gains have been made in the application of photonic energy (therapeutic laser energy) for photorejuvenation, and to treat a wide range of dermatological conditions. In the past few decades, non-ablative laser therapies have been used increasingly for the esthetic treatment of fine wrinkles, photoaged skin, and scars, a process known as photorejuvenation. Laser therapy was already known to increase microcirculation, vascular perfusion in the skin, alter platelet derived growth factor (PDGF), transforming growth factor and inhibiting apoptosis.

What is Therapeutic Laser Energy?

Therapeutic Laser Energy (Photonic Energy) is part of the electromagnetic spectrum, which ranges from radio waves to gamma rays. Electromagnetic radiation waves, as their names suggest, are fluctuations of electric and magnetic fields, which can transport energy from one medium to another across a barrier. Visible light is not inherently different from the other parts of the electromagnetic spectrum with the exception that the human eye can detect visible waves. Electromagnetic radiation can also be described in terms of a stream of photons which are massless particles each travelling with wavelike properties at the speed of light. A photon is the smallest quantity (quantum) of energy which can be transported, and it was the realization that light travelled in discrete quanta that was the origin of Quantum Theory.

Therapeutic laser energy is now used to treat acne, repair sun damaged skin, non-melanoma skin cancers, vitiligo, wound healing, and post elective surgery. In addition to photorejuvenation, laser therapy can be very useful in healing a wide range of dermatological conditions including the following:

1. Atopic Dermatitis
2. Contact Dermatitis
3. Contact Dermatitis
4. Atopic Dermatitis (Eczema)
5. Stasis Dermatitis
6. Seborrheic Dermatitis
7. Dyshidrotic Eczema
8. Hand Eczema
9. Erythromelalgia
10. Neurodermatitis
11. Nummular Eczema
12. Drug Eruptions
13. Solar Lentigo
14. Seborrheic Keratosis
15. Actinic Keratosis
16. Keratosis Pilaris
17. Telangiectasia
18. Port Wine Stains
19. Hives
20. Heat Rash (Miliaria)
21. Rashes caused by Stress
22. Rashes caused by Toxins in the Environment
23. Rashes caused by Circulatory or Vascular Conditions
24. Rashes caused by Fungal Infections
25. Rashes caused by bacterial Infections (Folliculitis, Impetigo)
26. Rashes caused by Viral Exanthems
27. Rashes caused by Parasitic Infections

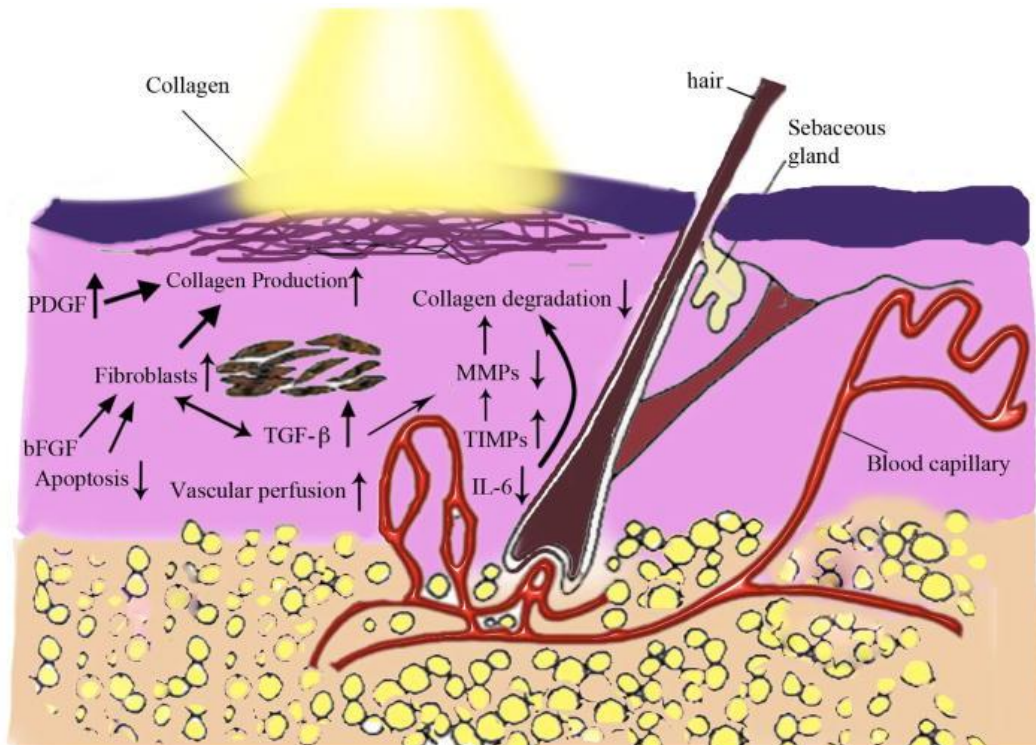
28. Rashes caused by medications
29. Rashes caused by Heat/Sun Exposure (Miliaria)

Mechanism of Action

The mechanism associated with the cellular photobiostimulation (laser therapy) occurs at the molecular, cellular, and tissue levels. The basic biological mechanism behind the effects of laser therapy is absorption of NIR light by mitochondrial chromophores (chromophores are substances present in living tissues that absorb wave energy in therapeutic wavelengths (808-980nm); examples of endogenous (existing inside the body) chromophores are melanin, hemoglobin, (oxyhemoglobin, de-oxyhemoglobin and methemoglobin), water, protein, peptide bonds, aromatic amino acids, nucleic acid, urocanic acid and bilirubin - exogenous (existing outside the body) compounds, like different colors of tattoo ink, also act as chromophores) including Cytochrome C Oxidase (CCO), which is contained in the respiratory chain located within the mitochondria, and also by photo-acceptors in the plasma membrane of cells and within DNA.

With laser therapy a cascade of biochemical interactions occur in targeted tissues, leading to stimulation and enhancement of various biochemical processes.

Laser therapy alters the cellular redox state which induces the activation of several intracellular signaling pathways, altering the affinity of transcription factors concerned with cell proliferation, survival, tissue repair and regeneration. Additionally, absorption of light energy causes photo-disassociation of inhibitory nitric oxide from CCO, leading to enhancement of enzyme activity, electron transport, mitochondrial respiration and adenosine triphosphate (ATP) production. (see figure below).



For additional information, please past this link in your browser:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4126803/>

[Treating Dermatological Conditions with Laser Therapy](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4126803/)

Treatments differ according to the etiology of the specific condition, and include irradiating the affected area for 5 to 10 minutes at 4-10Watts (depending on treatment location) 3 to 4 times per week with either 810nm or 980nm wavelengths until the condition is sufficiently improved.

Many of the conditions listed above can be completely resolved through application of proper dosages over proper intervals. Treatment outcome will differ slightly according to specific patient factors but overall outcomes will be similar.

Energy absorption coefficients are decided by the following energy/tissue interaction factors:

- Age
- Relative Health
- Weight (BMI, Or Body Mass Index)
- Skin Type/Color (Used To Determine Melanin Content)
- Tissue Hydration Level
- Tissue Location
- Sensitivity To Light & Heat
- Other Patient Factors
- Other Environmental Factors

The chart below can be considered a ‘baseline’ for determining treatment settings. As absorption coefficients are determined by the factors listed above, specific treatment settings are adjusted accordingly:

Mode	T-on	T-Off	secs.	area	hz rate	%	Power	Joules	density	J/cm ²
Mode	T-on	T-Off	seconds	cm	hz rate	%	Watts	Joules	Dens.	Dose
CW	-	-	420	100	-	-	6	2520	25J/cm ²	25J/cm ²
PULSE	700	100	480	100	1,250	.15	6	2880	29J/cm ²	25J/cm ²

Nummular Eczema

Patient was diagnosed with Nummular Eczema (as shown in figure 1); patient was treated three times at 8 W for 10 minutes (see figure 2) resulting in marked decrease in symptoms.

Figure 1.



Figure 2.



After nine treatments at 8 W for 10 minutes per treatment over the course of three weeks patient showed complete resolution of symptoms (see figure 3).

Figure 3.



Port Wine Stain

Patient was born with Port wine stain on chest (as shown in figure 1); improvement was shown after three treatments at 6 W for 10 minutes each (see figure 2); after the fifth treatment at the same settings additional progress occurred (see figure 3); this patient only had five treatments.

Figure 1.

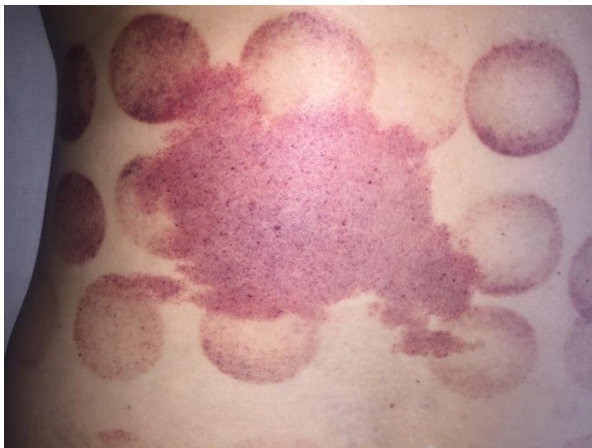


Figure 2.

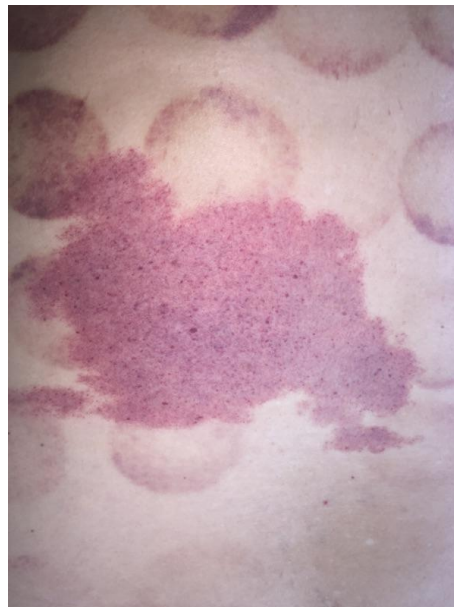
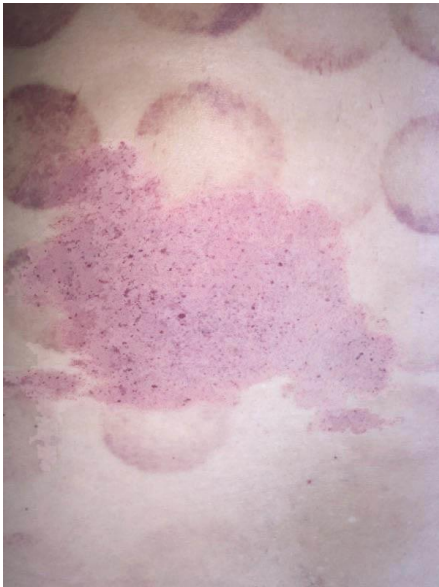


Figure 3.



Atopic Dermatitis

Patient presented with Atopic Dermatitis (as shown in figure 1); improvement was shown after three treatments at 6W for 10 minutes each (see figure 2); After nine treatments at 6W for 10 minutes per treatment over the course of three weeks, patient showed complete resolution of symptoms (see figure 3).

Figure 1.



Figure 2.



Figure 3.

