

## HOW DOES LED LIGHT TREAT ACNE?

LED light is a promising method to solve acne without the unpleasant side-effects of pharmaceuticals and invasive treatments. The increasing prevalence of dermatological diseases coupled with the rising demand for non-invasive treatments will augment industry growth for LED Light therapy forecasted to become a USD 1 billion industry by 2025, according to Global Market Insights Inc.

Do you wonder how LED light devices treat acne? This whitepaper will give you the necessary background information based on scientific research to understand the biological effects of LED light. Furthermore, it illustrates the effectiveness and safety of LED light therapy for acne.

The following questions will be answered:

- Why are new methods needed to treat acne?
- What biological effect does LED light therapy have on the skin to treat acne?
- How effective is LED light therapy on acne?
- What about the safety of LED light therapy?

## SUMMARY

Acne is the most common skin disorder and affects people in their teenage or young adult years. As building self-esteem is crucial in those years, many people want to solve their skin condition. However, pharmaceutical treatments have unpleasant side-effects or are less effective due to P. Acnes antibiotics resistance. LED light therapy is a non-invasive alternative method to solve acne with fewer side-effects.

LED light consists of narrow band wavelength light. For LED light therapy of acne, blue (415 nm) and red (630 nm) light are most widely used. Blue LED light calms inflammation and prevents future acne breakouts because of its antibacterial and sebum reducing effects. Red LED light (630 nm) repairs acne lesions and scars. Combining these two wavelengths for LED light therapy reaches an improvement of inflammatory lesions of over 80%. Furthermore, LED light therapy shows to be more effective with less side-effects than pharmaceuticals such as benzoyl peroxide and isotretinoin Overall, LED light therapy is safe for regular use. However, people with a light-sensitive skin must be aware of irritations and protective goggles must be worn to prevent eye damage.

## INTRODUCTION

We have all had a pimple at some point in our lives. Acne is therefore the most common type of skin disorder that affects almost everyone. Acne has a large impact on psychological well-being. It affects people in their teenage years and young adulthood during which confidence and self-esteem building is crucial. That is why many people want to get rid of their acne breakouts.

People with acne mostly search and try various products to solve their skin problem. They may turn to pharmaceuticals, but side-effects such as a dry and itchy skin, nose bleeds and dermatitis are far from comfortable. Furthermore, antibiotics resistance of bacteria *Propionibacterium Acnes* (*P. Acnes*) makes it necessary to keep exploring new treatments (1). LED light therapy is a promising alternative for pharmaceuticals to resolve acne without the unpleasant side-effects (1). This whitepaper explains the biological effects of LED light on acne and discusses its effectivity and safety.

“Antibiotics resistance of bacteria *Propionibacterium Acnes* (*P. Acnes*) makes it necessary to keep exploring new treatments.”



Contact details:  
Eva van der Kallen  
International Sales  
eva@demarkq.com  
+31648080115

## HOW DOES LED LIGHT THERAPY WORK?

Light-emitting diodes (LEDs) were originally developed by NASA to help grow plants in space. Later, researchers showed that LED light also has wound healing effects (2,3). This discovery led to further research into the therapeutic effects of LED light on rosacea, acne, skin ageing, muscle recovery and hair growth.

A LED is a semiconductor diode that emits light when an electrical current is applied. LEDs emit a narrow band of wavelengths of the visible light spectrum, which means they radiate light in one specific colour (Figure 1). The wavelength that is used for LED light therapy determines the penetrated skin depth and the type of biological effect on the skin. Two wavelengths are proven to be effective for treating acne: blue (415 nm) and red (630 nm) (4). Several LED light therapy devices that use these wavelengths have been cleared by the Federal Drug Association for the application of skin conditions (5).

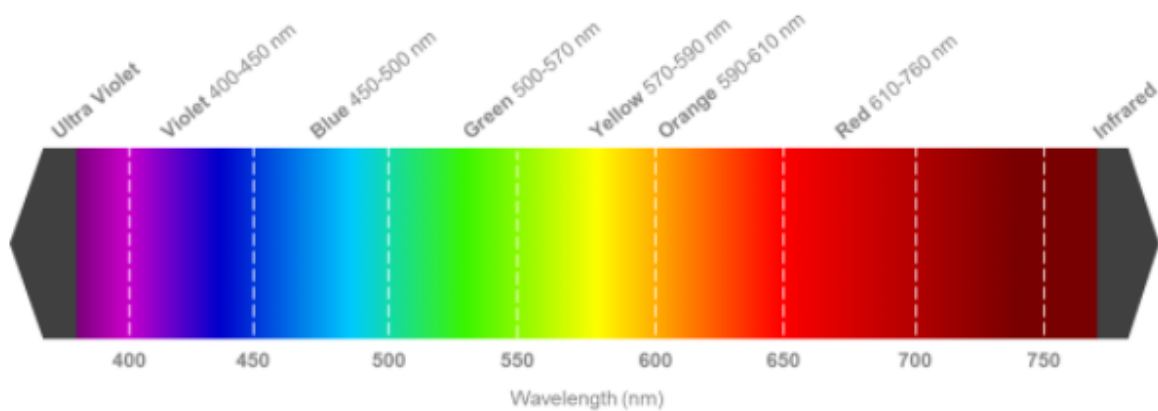


Figure 1. Visible light spectrum from violet (400-450 nm) to red (610-760 nm) light. Acne LED light therapy uses blue (415 nm) and red (630 nm) light.

## BLUE LED LIGHT

Calms inflammation and prevents future acne breakouts by

- Killing P. Acnes bacteria
- Reducing sebum overproduction

Blue LED light with a wavelength of 415 nm can decrease the severity of acne by killing bacteria that are present on the skin. Bacterial overgrowth of P. Acnes can result in inflammation and redness of the skin which is associated with acne (6). In order to reduce the inflammatory acne breakouts, blue LED light can be used. Blue LED light is absorbed by bacterial waste products and activates a toxic process that breaks down the bacteria (6). Blue LED light can therefore decrease inflammation related to acne by suppressing the growth of P. Acnes bacteria.

Another target of blue light is the sebum-producing gland. Sebum is an oily substance that is necessary for lubricating hair and skin. However, if the glands get overactive due to hormonal changes, this results in an excess of sebum leading to acne. Blue LED light can suppress proliferation of cells that produce sebum and therefore prevent future acne breakouts (4,7).

## RED LED LIGHT

Repairs acne lesions and scars by

- Increasing collagen production
- Recruiting wound healing cells
- Stimulating blood flow

Red LED light, with a wavelength of 630 nm, can penetrate deeper into the skin's layers than blue light (4). This enables it to reach fibroblasts which are cells that synthesize collagen (8). Collagen is required for wound-healing and helps to firm and tighten the skin. For that reason, collagen is important for repair of acne lesions and scars (9).

Red LED light supports collagen production by increasing the number of active mitochondria in fibroblasts. These mitochondria produce energy molecules which are called ATP. Increased energy within fibroblasts stimulates collagen formation and therefore supports healing of acne lesions (10). Red LED light therapy also activates anti-inflammatory cells and local blood flow. This improves repair of acne lesions and scars, because it increases the amount of nutrients, oxygen and recruitment of wound healing cells (11).

## HOW EFFECTIVE IS LED LIGHT THERAPY FOR ACNE

Several studies investigated the effectiveness of LED light therapy for mild-to-moderate acne. The effects of LED light therapy on acne were evaluated by the number of non-inflammatory lesions (closed and open comedones) and inflammatory lesions (papules, pustules, nodules and cysts) reported by dermatologists. Furthermore, adverse events were monitored.

In summary, inflammatory lesions are more affected by blue or red LED light therapy than non-inflammatory lesions: a decrease of 40-80% for inflammatory lesions versus 30%-60% for non-inflammatory lesions (4,12-15). In these studies, either no adverse events or mild skin dryness was observed (4,12-15). The varying results can be explained by different study designs: for example light source properties, total number of treatments, treatment time and severity of acne.

Red and blue LED light therapy applied sequentially showed the best results with a decrease of inflammatory lesions of over 80% (13,16). Studies also compared LED light therapy with pharmaceutical acne treatments. LED light therapy was superior based upon decrease of acne lesions and adverse events over benzoyl peroxide and isotretinoin (14,17,18).

LED light therapy affects inflammatory acne lesions more than non-inflammatory lesions.

A combination of red and blue LED light therapy shows the best results with a decrease of inflammatory lesions of over 80%.

LED light therapy is superior upon decreasing acne lesions over pharmaceuticals such as benzoyl peroxide and isotretinoin.

## WHAT ABOUT THE SAFETY OF LED LIGHT THERAPY?

In the beauty world, LED light therapy is a fast-rising solution for dermatological conditions. Optical radiation of LED light is generally safe for eyes and skin within set values for exposure duration, wavelength and the intensity of the light (19). However, users should always check whether the LED light devices are cleared by the FDA and have been produced based upon ISO standards.

LED light does not contain harmful UV rays, so it is safe for regular use and will not cause skin burn. However, some people might have a skin type that is more sensitive to light or use medication that increases their sensitivity to light (20). In these instances it is not advised to use any light therapy. Furthermore, users should always read the manual of LED light therapy products thoroughly and use the product accordingly.

Another important safety concept is the effect of blue LED light on the eyes. The time of direct exposure of blue light to the eyes must be limited to prevent retinal damage (21). When using blue LED light therapy for the skin, it is therefore advised to wear protective goggles (Figure 2).

Overall, LED light therapy is a safe and non-invasive way to treat acne lesions with less side effects than pharmaceutical treatments.



Figure 2

## CONCLUSION

LED light therapy is an effective method to treat acne. It helps fight against bacterial infections that cause severe acne cysts, prevents excessive sebum production and helps to repair the skin. It is a safe, non-invasive treatment and can be used as an alternative for pharmaceuticals. Therefore, it is a promising and emerging treatment method for a pressing issue under teenagers and adults that have to fight against acne while building their self-esteem.

Interested in learning more about LED light therapy for skin conditions? You are at the right place. Light Tree Ventures is specialized in research, development and manufacturing of LED light therapy products. Contact our business developer Kim Markwat to learn more about our solutions. Let's create a product together with the power of light!

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