

Research Information

This page is dedicated to the study and explanation of one of the newest surgical methods that takes advantage of IR radiation in medical therapies mentioned in the introduction. Various studies have been performed that indicate a promising future for the medical application described below.

Monochromatic IR Energy Used to Heal Venous Ulcers

Food and Drug Administration-cleared monochromatic IR energy (MIRE) devices have been demonstrated to greatly improve the healing time of venous ulcers that have shown little to no signs of improvement with conventional wound management and healing techniques. MIRE devices were originally developed for increasing circulation and pain reduction. They consist of 2 flexible 22.5 centimeter square (22.5 cm^2) pads that use Gallium Aluminum Arsenide diodes to produce 9 milliwatts per centimeter squared ($9 \times 10^{-3} / \text{cm}^2$) of continuous IR radiation with a wavelength of 890 nanometers (890×10^{-9} meters). The design of the pads allows the radiation to strike the skin surface at the desired 90 degree angle. The chief method for using the MIRE consisted of weekly radiation exposures directly onto the ulcer and surrounding skin for a half an hour at a time, followed by wrapping the ulcer with bandages moistened slightly with sterile saline. Marked improvement was noticed within a month of treatment for most patients. Ulcers reduced in size more rapidly than from other treatments while pain experienced from the ulcers dropped by more than most patients indicated they had ever experienced. Similar signs of improvement were demonstrated in patients who had been undergoing many different treatments and approaches for months and even years to heal the ulcers but had shown no signs of improvement until they attempted the IR treatment. Researchers attribute the marked improvement in healing rates to the MIRE device's ability to increase levels of nitric oxide (NO) in the bloodstream around the wound. Previous studies have already shown that increasing NO levels in and around wounds improves the rates and quality of their healing. However, delivering NO locally has proved to be difficult considering its instability. Free NO breaks down after less than 5 seconds, which makes direct delivery of it to a wound site nearly impossible.

NO is a powerful vasodilator. This means that it aids in circulation by dilating arterioles which in turn increases oxygenation levels, nutrient delivery, and removal of waste products in the blood stream. There are large quantities of NO in the blood stream at any given point. The red blood cells pick it up along with oxygen when air is breathed into the lungs. However, the NO is usually tightly bound to hemoglobin (the chief molecule found in red blood cells) and hence not available to wound sites in its beneficial, free state. It has already been proven that various wavelengths of electromagnetic energy can be used to free NO from its chemical bond to hemoglobin. The energy absorbed by the NO from the radiation excites it to a state where it is no longer tightly bound to the hemoglobin, releasing it into the bloodstream. The NO then goes on to act as a vasodilator, which provides the conditions necessary for healing to take place. You might wonder how much good a molecule that lives less than 5 seconds can do in its short lifetime. The answer is, not much. However, there are a few points to keep in mind in understanding how helpful the MIRE device is in the healing process. An integral part of this therapy is the fact that while NO is attached to hemoglobin, it is stable; in other words, it will not break down after five seconds like it would if it were free. Not until the NO is freed from the red blood cells does its short lifetime begin to take effect. Because the blood flow provides a steady stream of red blood cells carrying NO, and the MIRE device releases this NO just as it reaches the wound area, an uninterrupted flow of this

beneficial molecule is delivered directly to the wound sight. It is this continuous flow of the vasodilating NO that makes such an important difference in healing.

Here are some remarkable demonstrations of the healing ability of the MIRE device when used according to the protocol described above. The following are photos (courtesy of Horwitz, et. al.) of venous ulcers before and after various lengths of MIRE treatments. Keep in mind, these wounds had been proven to be stagnant or had deteriorated after years of conventional healing methods and thus we can assume that they would have remained the same without MIRE treatment.