How Infrared Light Helps the Body with Healing

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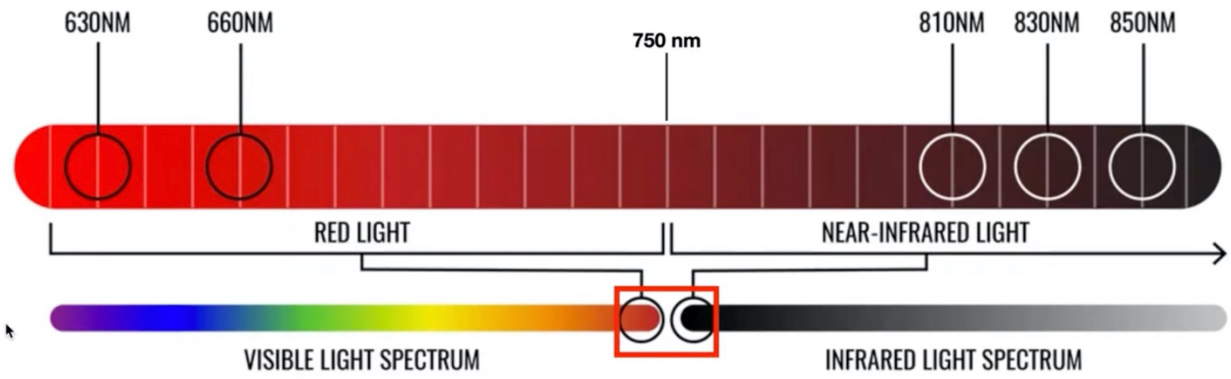


Infrared light therapy, although it is technically under the classification of heat, works quite a bit differently than regular heat does, and to understand that, let's actually take a look at this picture. This image shows the spectrum of light, or at least a part of the spectrum of light. Over on the left, we see the visible spectrum, these are the colors that we can see. On the far left, we have purple, also called violet, and then we have indigo, blue, green, yellow, orange, and red on the right.

Then if we look at the right side, the spectrum of red, this is the near infrared and infrared parts of the spectrum. In the two circles with the red box, this is the near infrared spectrum, and everything to the right is the infrared spectrum. What's in the red box is blown up larger at the top of the image.

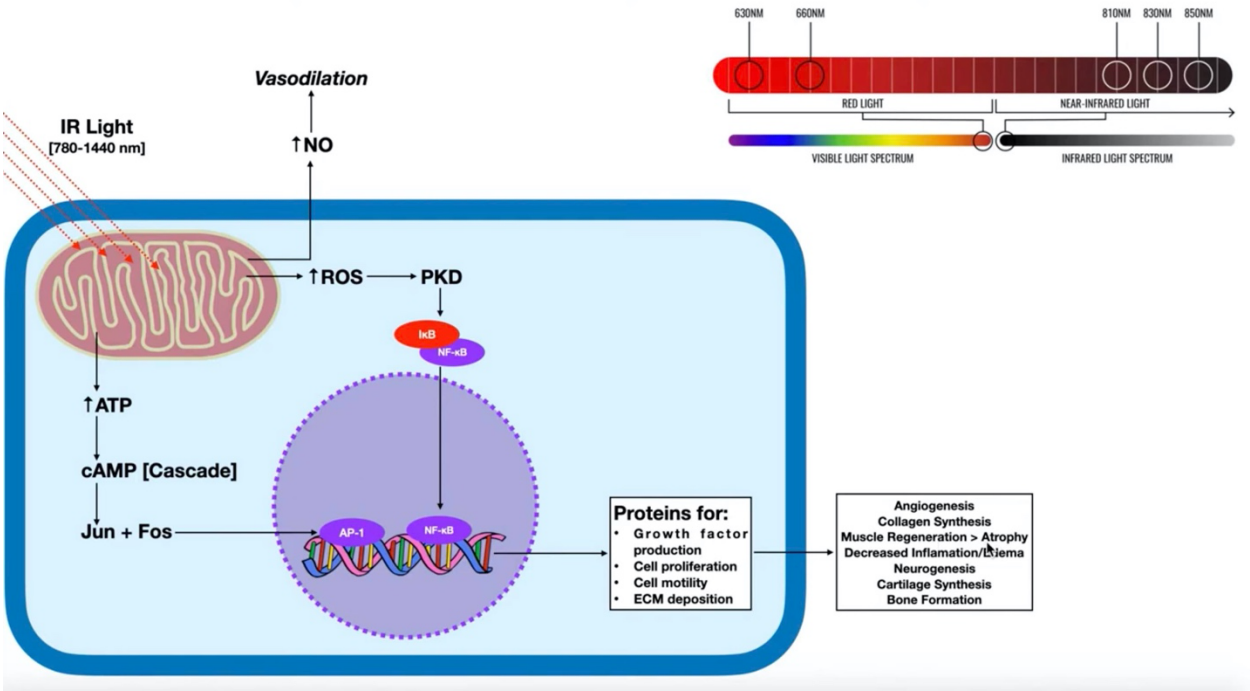
The visible part of the red light spectrum (from the middle to the left) goes from about 750 nanometers (nm) down to about 620nm; technically it goes a little bit below that. But these are the wavelengths of about 620 to 750 nanometers, that's the visible red light spectrum. As we go above 750 nanometers up to about 810, 838. 850nm, we start to get into the near infrared part of the spectrum, and above that is going to be the infrared spectrum.

Why is it important to understand this? Well, first of all, as we go towards the right on the spectrum, notice that the wavelengths are increasing, so we go from 630 nanometers all the way up to 850. Now when we compare a wavelength to energy, they have an inverse relationship. As the wavelength increases, the energy of the light decreases.

What that means is that if we look at red light, near infrared, or infrared, it has a fairly high wavelength, and that means it has a low energy. If we go to the left side of the light spectrum which is violet, to the left of that is ultraviolet, which we don't see. Those are lower wavelengths, and therefore higher energies.

Ultraviolet light penetrates through to deeper tissues, but it's high enough energy to cause DNA mutation, and all sorts of other kinds of cellular damage. The red light, near infrared, and infrared light is higher wavelength, and so it's lower in energy. And so it still penetrates to the skin and into deeper tissues where it has biological effects, but it's not high enough energy to cause DNA damage or cellular damage.

And when we think of a therapy, it has to have some benefit to the patient, but it also can't cause a significant amount of damage. Well, ultraviolet light would clearly cause damage and that's why we don't use ultraviolet light, but infrared light doesn't cause damage.



I want to talk a little bit about how infrared light therapy actually works. And to do that, here we have a diagram of a cell. The outer border in dark blue is the cell membrane. Inside is the cytoplasm, and the circle is the nucleus with the DNA contained inside. And then up at the top left of the cell is the mitochondria. And then we have these light waves being shown on the cell. Generally, the light that's being emitted is going to be red, near infrared, and infrared light.

The red light below 750 nanometers is visible, but it doesn't have the same biological effects as near infrared or infrared light does. Infrared light is not in the visible spectrum, so we can't see that light.

The way that these infrared light waves actually exert biological effects on cells is by triggering certain actions of the mitochondria. The first is through the production of nitric oxide. Nitric oxide is a potent vasodilator. If you are locally increasing nitric oxide production, you're going to get local vasodilation, which means increased blood flow to that area.

This means that infrared light therapy can actually accelerate wound healing, especially in the acute phase of wound.

As an example, if somebody has an inversion ankle sprain, and they have some ruptured ligaments, and you want to get those healed pretty quickly, **you might actually try infrared light therapy because that increased nitric oxide production in that area** of the ankle sprain is going to lead to vasodilation in that area, and thus **increased blood delivery** to that area. And of course, **blood brings nutrients and the more nutrients you have, the quicker that tissue is going to heal.**

The second thing that infrared light therapy does is it increases the production of ATP by the mitochondria. When you have increased ATP, it leads to the production of more Cyclic AMP. This is just a small molecule that's related to ATP. But when Cyclic AMP accumulates, and you get more and more of it, it triggers a cascade of protein and enzyme activation that terminates in the activation of two transcription factors, one is called Jun, and one is called Fos. These are strange names, right? Well, Jun and Fos are Transcription Factors, and they can dimerize, which basically means that they can combine. And they enter the nucleus into a combined Transcription Factor called AP-1, which exerts some biological effects that we're going see in just a minute.

Another thing that infrared light therapy does is it actually triggers the production of Reactive Oxidative Species (ROS) by the mitochondria. Now, I know what you're probably thinking. ROS are bad, right? That's the free radical theory of aging. How can ROS be good? Well, there's this thing called hormesis. Hormesis is a concept that when you have a small amount of ROS it actually can serve some benefit. It's when you get them out of whack and there's tons of ROS, that's when you have things like chronic inflammation and so forth. But this is just a small increase in ROS, and it's enough to trigger a special activation of proteins.

This increased production of ROS triggers the activation of a protein called Kinase-D. Protein Kinase D leads to the activation of a special regulatory protein complex and transcription factor called NF-kB (nuclear factor kappa B). The short story is there's a regulatory protein called I-kappa-B (IkB) that keeps NF-kB inactivated. Protein Kinase-D phosphorylates IkB, which allows it to let go of NF-kB. And when it lets go NF-kB, NF-kB can then enter the nucleus. It's a transcription factor also, and so it binds to the DNA and is going to upregulate certain genes.

Collectively, AP-1 from our second pathway, and NF-kB from our third pathway, are going to **lead to an increased production of proteins that are growth factors.** These growth factors are involved in cell proliferation, cell motility, which is the movement of certain cells to an area or around an area, and also deposition of more extracellular matrix. **All four of these things are excellent for cellular and tissue repair.**

Here's some of the basic effects of having these types of proteins upregulated:

We get angiogenesis, the growth of new blood vessels, particularly capillaries that sprout from larger blood vessels to supply the area and get increased healing. You have to get increased blood flow to an area to get it to heal.

We also get more collagen synthesis. Collagen provides that tensile strength in the extracellular matrix. Also, if there's any scar tissue necessary, the collagen is going to make up that tissue as well.

What we also see is that muscle regeneration with the use of infrared light therapy is going to be greater than atrophy. Usually if you have something like an inversion ankle sprain, you're not going to be using that ankle as much. You're not going to be putting weight on it and generally not going to be moving it because it's painful.

With infrared light therapy, we can actually trigger more regeneration of those muscles or that muscle tissue which prevents atrophy. In order to maintain the tissue, the regeneration has to at least equal the atrophy or be greater than it.

We also get neurogenesis and cartilage synthesis. Again, if we have an acute injury, we can have nerve damage. And also depending on the injury type, we can also have cartilage damage.

And we also get increased bone formation. Don't think that an inversion ankle sprain is the only thing we can use this for. **You can also use this for a fracture. Again, the same principles are going to apply. We need more blood flow to the area, we need more collagen synthesis, especially if it's bone because bone is largely collagen.**

And all of these things really just culminate in the fact that we have increased wound healing, increased tissue repair, and increased relief from pain.

Transcript from video:
https://m.youtube.com/watch?v=CZpbxFo27NM
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