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The Effect of Light therapy on Chronic Pain

Chronic pain is a major health problem. In the United States alone, more than 100 million patients have been identified with chronic pain [1]. On average, 261-300 billion US dollars are spent every year to manage pain and 297-336 billions US dollars are lost to work productivity [1]. Aside from the financial burden chronic pain places on our society and health care system, the emotional tax produced by chronic pain has resulted in severe life altering events that ranges from shattering family unites [2] to suicide attempts [3-5].
Opioids have been the gold standard to treat chronic pain [4]. Sadly, there are many side effects associated with chronic opioid use [5]. Other classes of medications have also been utilized to control chronic pain such as NSAIDs, antidepressants, anticonvulsants, gabapentoids, and recently cannabinoids.

Regardless of the class of medications employed, patients always run the risk of developing side effects. Some of these side effects may be fatal. Given the long lasting nature of chronic pain, the odds of developing side effects, whether social or medical, will increase with time.

An ideal approach would be to develop agents or techniques that are safe, effective, and affordable for long-term use to control chronic pain.

Light therapy for managing pain remains underutilized. This may be mainly due to insufficient basic science data regarding the mechanisms. In an attempt to investigate the mechanism of controlling pain using light therapy, Hwang at el investigated the role of three wavelengths (405, 532, and 650 nanometer) on inflammatory mediators released by human annulus fibrosus cells treated with macrophage-like cells conditioned media containing pro-inflammatory cytokines and chemokines. The 405-nanometer light significantly reduced the release of IL-6 in a time dependent manner. The levels of IL-8 was reduced significantly with all wavelengths used, thus providing a possible mechanism for light therapy pain control [6].

Our pilot studies have shown behavioral responses in naïve and chronic pain model rats when exposed to certain light emitting diodes (LED) wavelengths. When naïve rats were exposed to green or blue LED light for 8 hours a day over five days it produced significant antinociception (analgesia) manifested by prolonged paw withdrawal latency from a heat source. This antinociception lasted for four days after green LED light was terminated. White LED light had no effect of rats. The antinociception effect of green LED was reversed when naloxone or CB1cannabinoid receptor antagonist was on board. The peripheral CB2 cannabinoid receptor antagonism failed to reverse the antinociception effect of green LED light. Therefore, there seems to be a significant role for the endogenous endorphin and cannabinoids system. Similar effects were achieved in rats of chronic pain model.

Given the safety of using light and the relative affordability of LED light, our hypothesis is that exposing chronic pain patients to green or blue LED light will control their pain or at least lower their pain medication requirement. This grant

will enable us to conduct a small clinical trial that may provide us with initial data to apply for more significant federal grant for a larger clinical trial with greater number and variety of chronic pain patients.

Specific Aim : Investigate the effect of green and blue LED light on patients with chronic pain.

Patient with chronic pain will be recruited from the pain clinic. The patients will be randomized into three groups. Each group will contain 10 patients. The first group will be control group exposed to white LED light. The second group will be exposed to green LED light. The third group will be exposed to blue LED light. Patients will be given the LED light and asked to conduct the experiment at home and keep pain intensity and pain medications diaries. Each patient will be asked to set in a dark room for two hours a day and activate the light provided to him or her for 7 days. A success will be defined as improved daily activities and functionality, better sleep, decreased pain intensity, or decreased pain medicine use by the end of day 7.

Significance:

A. We open the door for the use of LED of a safe wavelength, with virtually no side effects, to offer a novel way of managing chronic pain
B. There is practically no counter indication for the use of green or blue LED therapy.
C. Potential for lowering opioids, and other pain medication, and lowering the associated side effects, misuse, dependence, legal and social consequences of chronic use.
D. Very affordable cost associated with using green or blue LED therapy.

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