Effect of Red-Light Therapy on Heart Rate and Blood Pressure

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Abstract:
Several studies point to the positive effects that low-power light treatment can have on the healing process of wounds. However, the employment of LEDs as a kind of therapeutic intervention is still a contentious topic. There are questions over whether or not the impacts that are generated on biological systems by LED and LASER are comparable to one another. This experiment had several objectives, one of which was to determine the biological effects that offer support to the employment of LED on heart rate and blood pressure. Changes in the light intensity of different colors can produce shifts in a broad number of physiological states and indices. Some of these states and indices include melatonin, alertness, body temperature, heart rate (HR), and heart rate variability (HRV). Following exposure to red light, the purpose of this pilot research was to explore any sudden changes that occurred in HR as well as blood pressure.

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I. INTRODUCTION

People are particularly sensitive to light, and small shifts in light intensity may cause large shifts in a variety of physiological markers, including melatonin, alertness, body temperature, heart rate (HR), and heart rate variability (HRV) [1]. In this respect, the impacts of colored light, in addition to the alterations that are based on variations in the brightness and whiteness of the light, have been explored in a few scientific research. The use of noninvasive light to generate a therapeutic effect is something that may be used to a wide variety of devices that emit light. The utilization of light emitting diodes (LEDs) in therapeutic settings has arisen as a result of recent technological developments involving their use. Altering the ambiance of a working space may frequently be accomplished by utilizing lighting of a variety of hues. This is a tried-and-true method. As a result of the development of more advanced organic light-emitting diodes (OLED) in a variety of hues, the undertaking turned into a highly practical and inexpensive aesthetic component at the majority of workplaces. It is well recognized that certain lightings may have an effect on both our mental and bodily states, particularly in a variety of diurnal settings such as while we are working, studying, relaxing, or sleeping.[7] It would appear that various light components have varying effects on the various physiological markers.[8], [9] Previous researchers have conducted extensive research on the influence that color has on a variety of mental states, including anxiety, sadness, and others.[9],[10] Therefore, it is possible that certain wavelengths of light are engaged in the regulation of blood pressure, putting into play the function that environmental influences play.[11] The effect that light has on a variety of physiological indicators is significantly influenced not only by the wavelengths of the light but also by the color temperature of the light.[12] The researchers investigated a non-visual response

that is caused by light and is mediated through the retino-hypothalamic tract.[4] It also induces a change in the circadian cycle (via melatonin and its mechanism), which cannot be ignored either. This is another effect that cannot be ignored.

II. MATERIALS ANDMETHODOLOGY

The practitioner shines colored light such as red light directly on the patient during colored light treatment. During colored light therapy, the practitioner also continually monitors the patient's vital signs, such as blood pressure and heart rate. Both high blood pressure and a slow heart rate are indicators of a frequent clinical condition that poses a significant threat to human health. In this study, college students and faculty members were stimulated in order to demonstrate the effects of red light on the variability of their heart rates.The effective red-light therapy is implemented by measuring various body parameters like visceral fat, trunk fat, and body mass index, muscle mass %, body fat, and blood pressure, hemoglobin percentage in body, height, and weight.

Body parameters play an important role in the result of red light therapy. If fat content of the body is more required more light for deep penetration which may increase the time of therapy.

Initial a system is developed which consist close chamber and 8 red light of 25 watt and its intensity can be adjusted according to the requirement. This model can focus a light on person setting in fort of it. Light is focus on person for maximum 45 min. and corresponding automated blood pressure device and an electrocardiogram (ECG) machine are used to monitor blood pressure and heart rate, respectively. For the heart rate measurement, an electrocardiogram (ECG) machine is used. But using this model there is no variation in heart rate and blood pressure.

Second model is developed with 8 red lights of 60 watt and its intensity can be adjusted according to requirement. Using this model again the variations in blood pressure and heart rate is very negligible because light is not extremely penetrating in the body.

A third variant that focuses red light of 150 watts and has a high intensity and can penetrate very far into the body has been created.

III . RESULT AND DISCUSSION

Before beginning colored light treatment, numerous parameters of the body are evaluated, including blood pressure, body mass index (BMI), body fat, trunk fat, visceral fat, muscle mass percentage, height, and weight, as indicated in table (5.5). Colored light therapy has been demonstrated to be effective in treating a variety of conditions. A red light with a high intensity is shone directly on the patient, who is positioned in a special cardiac chamber, while other physiological parameters, such as blood pressure and heart rate, are continually monitored.

Table (1) Various body parameters.

Age	R-R Interval Sec.	Heart Rate BPM	Blood Pressure	Ht. (CM)	Wt. (Kg)	BMI 20.1-23	Trunk Fat <15	Body Fat 10-20	Muscle mass 33-36	Visceral Fat 2-8
20	0.66	90	122:80	165	53	19.8	15.2	18	35.8	4

The wave shape of an electrocardiogram is seen in Figure (1) before a person is exposed to high intensity redlight.

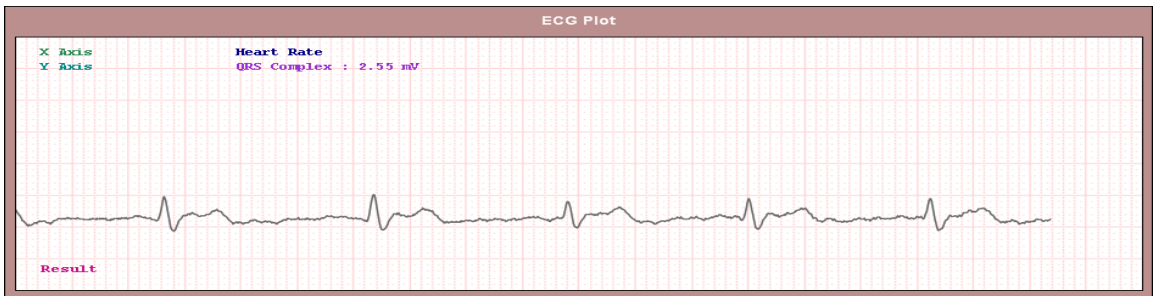

Figure (1) ECG wave before red light effect

The patient's blood pressure was tested with the assistance of an automatic blood pressure measuring device, and the results were as follows: systolic pressure of 122 and diastolic pressure of 80, with the average RR interval coming in at 0.66 and the average heart rate coming in at 90 beats per minute. Now the patient will be exposed to a red-colored light for a period of thirty minutes, and their heart rate and blood pressure will be monitored throughout this time.

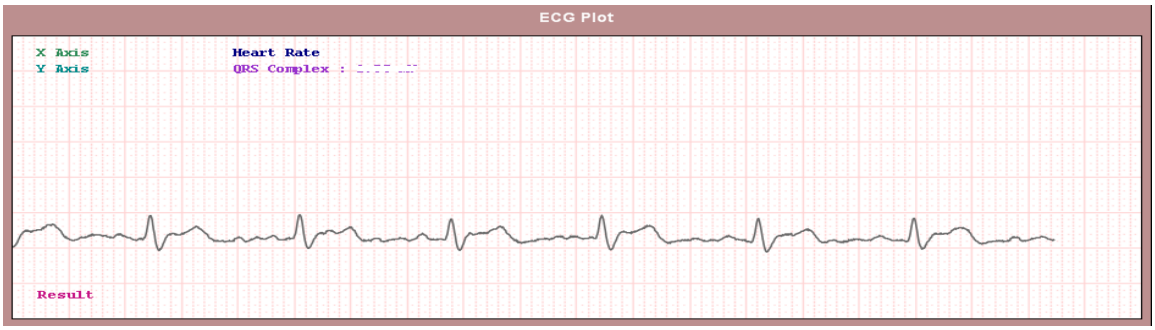

Figure 2: The electrocardiogram taken after the red light influence

Figure 2 depicts the wave shape of an electrocardiogram after the red-light effect has been applied. The average RR interval is 0.54, and the patient's average heart rate corresponds to 111 beats per minute. The blood pressure of the patient is checked with the assistance of an automated BP device, and the results are 110 over 74 for the systolic and diastolic readings, respectively. Following treatment with colored red light, the patient's heart rate increases by 21 beats per minute, and their systolic and diastolic blood pressures return to their normal ratio of 12:6.

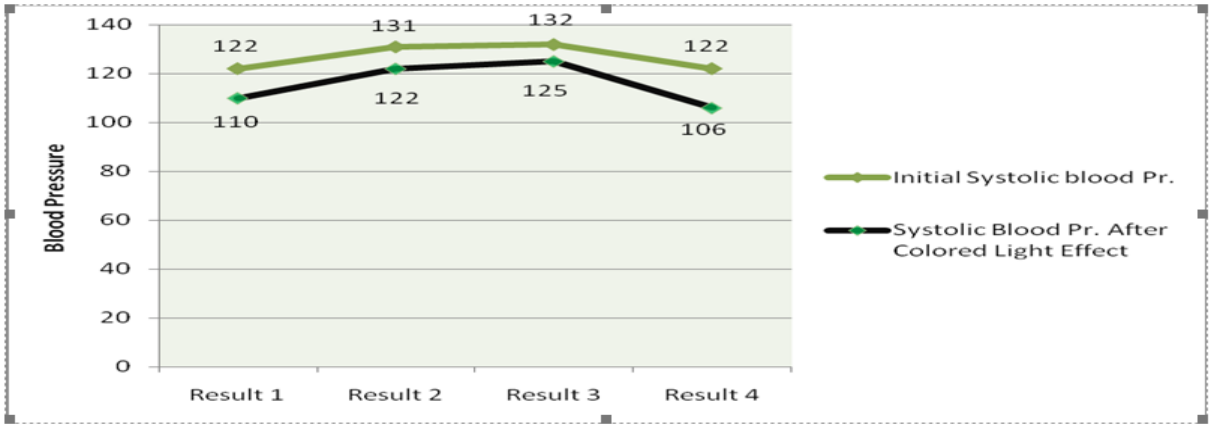

Figure 3: Variation in blood pressure readings before and after exposure to colored light

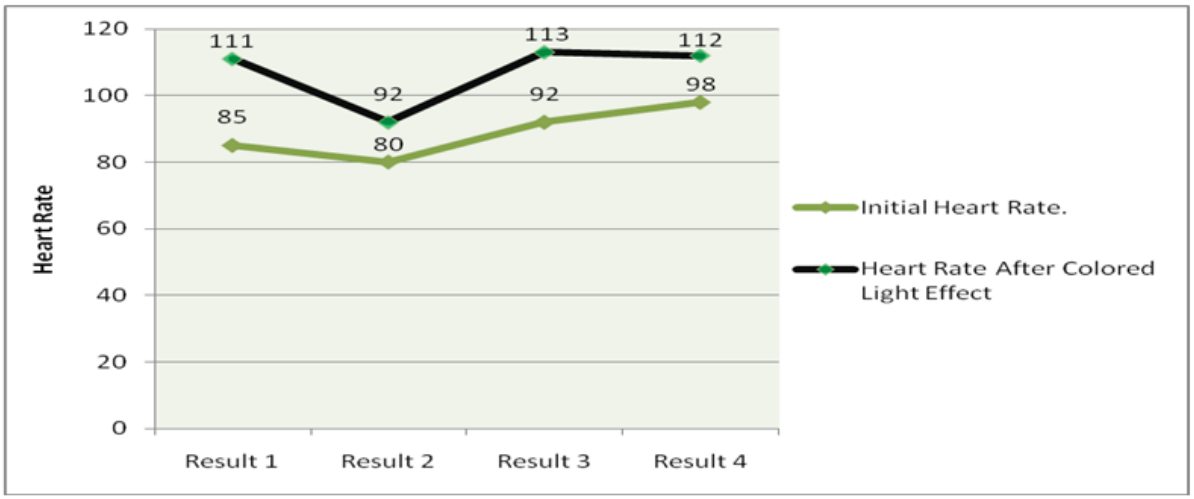

Figure 4: Variation in Heart Rate Observed After Exposure to Colored Red Light

IV. CONCLUSION

According to the findings, colored light treatment is an efficient method for increasing one's heart rate, which is beneficial for patients who are afflicted with a bradycardia refers to a slow heart rate. At the same time, it is capable of bringing down high blood pressure to some level.. The variation in heart rate and blood pressure after red light therapy are different from person to person depend on its physical body parameters like hemoglobin %, body fat, elasticity of blood vessel, blood pressure, nitric oxide of blood vessel etc.

The colored red light therapy penetrate the light deeply, as shown in result if the fat content of the body is more required more time for deep penetration , hence the time of this therapy depend upon the fat content of the human body. Patient with more fat content required more time for deep penetration of light.

In case of low blood pressure, blood vessels Because the walls of the tubes are flexible, the space contained within the arteries may be stretched out or contracted as needed. When there is more room, there is effectively less fluid, which results in a decrease in pressure. As the volume of the space decreases, the pressure will increase. Arteries have layers of muscles within their walls that have the ability to contract and narrow the artery, resulting in less room within the arteries themselves. This happens when the artery is narrowed. Alternately, the muscles can loosen their grip on the artery, which will cause it to expand and make more room.

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