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Effect of green Low-Level Laser (LLL) on the white blood cells and platelet of people with brain and prostate cancer

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ABSTRACT

The effect of Low-Level Laser (LLL) provided by green semiconductor laser with an emission wavelength of 532 nm on of human blood of people with brain and prostate cancer has been investigated. The effect of LLL on white blood cell (WBC), NEUT, LYMPH and MONO has been considered. Platelet count (PLT) has also been considered in this work. 2 ml of blood sample were irradiating by a green laser of the dose of 4.8 J/cm2. The results suggest a potential effect of LLL on WBC, PLT, NEUT, LYMPH, and MONO of people with brain and prostate cancer

Key words: White blood cell, platelet, low-level laser therapy

INTRODUCTION

For more than 4 decades, LLL effects on human blood including modifications in structural and functional properties have been studied for various irradiation protocols with a broad spectral range (from near UV to near-infrared) and through different irradiation methods such as intravenous and transcutaneous blood irradiation [1,2]. LLL irradiation can cause many biological effects in living cells, such as blood, mostly via biochemical biomodulation rather than direct thermal effects [3]. Currently, LLL irradiation has widespread applications in different areas of medicine [4].

Laser parameters such as wavelength, energy, dose, and laser duration usually determine the photothermal effects of the laser on blood cells [5]. Such parameters should be chosen carefully because they have a strong relationship with their effect on tissues (blood samples), which can stimulate or inhibit physiological and biochemical processes [6]. Therefore, more research is required to understand the effects of these different parameters of LLL irradiation on human blood cells.

Since the effects of LLLT on the normal human blood have received huge investigations, almost there are no scientific reports about the effect of LLL on the blood of people with brain and prostate cancer.

The aim of the present work is to evaluate the effect of LLL on WBC and PL of human blood of people with brain and prostate cancer.

CASE PRESENTATION

A young woman came in an emergency with complaint of recurrent pain in the abdomen mostly the suprapubic area for about a week. There was no radiation or migration to other areas of the abdomen. She often complained about the difficulty in passing urine. No haematuria was reported. The patient denied any history of vomiting, jaundice and steatorrhea. Later the patient became febrile. On physical examination, the patient was an active woman with a good build and BMI. Her heart rate was 86 per minute, BP 110/76 mm of Hg, and temperature 38.0°C. On examination the abdomen was soft with a 3 cm sized tender swelling above the bladder. The blood counts, urinalysis, electrolytes, and renal function tests were found normal. Ultrasonography revealed a 2 cm × 15 cm sized lesion above the bladder. A Contrast-Enhanced CT scan (CECT) was done that confirmed a non-communicating urachal cyst between urinary bladder and anterior abdominal wall. The E. coli were grown in urine culture. The patient's infection was successfully treated with

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parenteral amikacin.

Limitations of the Study

Some considerations and limitations regarding human blood components for patients or healthy persons under diagnosis with LLL should be taken into account. An example of this limitation is the number of lymphocyte cells where it has been found there is no specific number of lymphocyte cells that are necessary to keep the body healthy. This is because lymphocyte levels can change according to a person's race, gender, location, and lifestyle habits. On the other hand, this kind of limitation or so-called threshold can vary between labs and people of different ages [7]. Other human blood components may undergo such these kinds of limitations.

Experimental

The blood samples of humans were collected from adult donors (15 females and 10 males) aged 20 years - 65 years. The protocol of this study was permitted by the research ethics committee in the Physiology Department, College of Medicine, The University of Baghdad, Baghdad, Iraq, and written agreements were taken from the donors. Blood samples have been saved in containers containing the anticoagulant EDTA then they have been divided into two groups. One group was a control, while the second group has been subjected to LLL provided by a semiconductor pointer laser with an emission wavelength of 532 nm. The dose of laser on the surface of the blood sample was 4.8 J/cm^2. The green diode laser pointer parameters used in this work are shown in Table 1.

Table 2 shows the normal blood parameters, and before and after applying LLL of dose of 4.8 J/cm^2 on the blood samples for WBC, NEUT, LYMPH, MONO, and PLT.

RESULT AND DISCUSSION

Low-Level Laser restores health by removing the underlying causes of ill-health by decreasing inflammation, increasing oxygen and blood flow, promoting muscle calcium uptake, and increasing neurotransmitter release [8,9]. Laser light passes through the skin and stimulates the cells energy production centre, called the mitochondria, creating more energy, better cell communication, improved tissue growth, enhanced cell nutrition, and extended cell life [10,11].

In this work, the irradiated sample by LLL has received laser irradiation from the laser device whose parameters are listed in Table 1. The results demonstrated that the WBC count has decreased slightly reaching the value of 10.37 × 103/µL, this value falls into the normal range (4.1-11) × 103/µL, while the initial value of WBC is 11.44. Results also indicated that the lymphocyte count has been increased and Neutrophils after exposure to LLL, this because Low-Level Laser light stimulates cell receptors to increase cell energy production and any time one cell was stimulated to create energy, many other cells will also be stimulated to produce more energy. Improving cell proliferation, migration and prevention of cell apoptosis. LLL irradiation revealed short-term effects on human blood cells involving changes in erythrocyte membrane which leads to the release of factors into the blood that appears to stimulate further changes, structural changes in plasma proteins, activation of complement and other components against foreign bodies, releases of oxygen free radicals, a decrease

Tab. 1. The green diode laser pointer parameters used to as a source of LLL.

Value	Parameter
532 nm	Wavelength
60 mW	Output power
CW	Laser operation mode
2 cm	Laser diameter on the sample
3.14 cm^2	Spot size
19.1 mW/cm^2	Power density (irradiance)
4.8 J/cm^2	Energy density (dose)

Tab. 2. Laser effects on some blood components.

Parameter	Normal range 10^3/µL	Before exposure	After exposure
WBC	4.1-11	11.44	10.37
NEUT	1.5-7	7.98	6.32
LYMPH	1-3.7	2.3	3.41
MONO	0-0.7	1.15	0.5
PLT	150-400	295	235

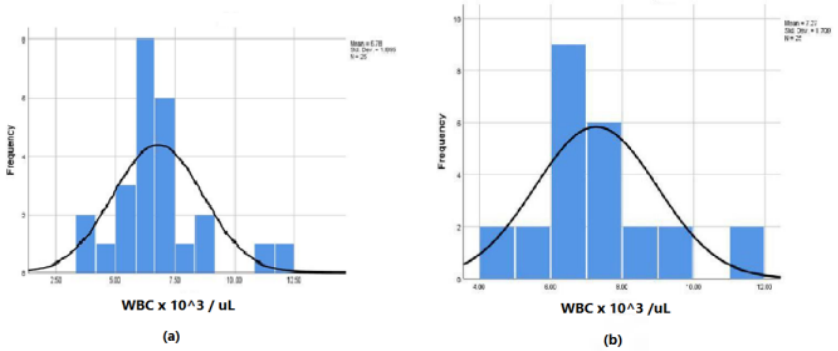

Fig.1. Histogram of WBC number (a) before applying LLL (b) after applying LLL

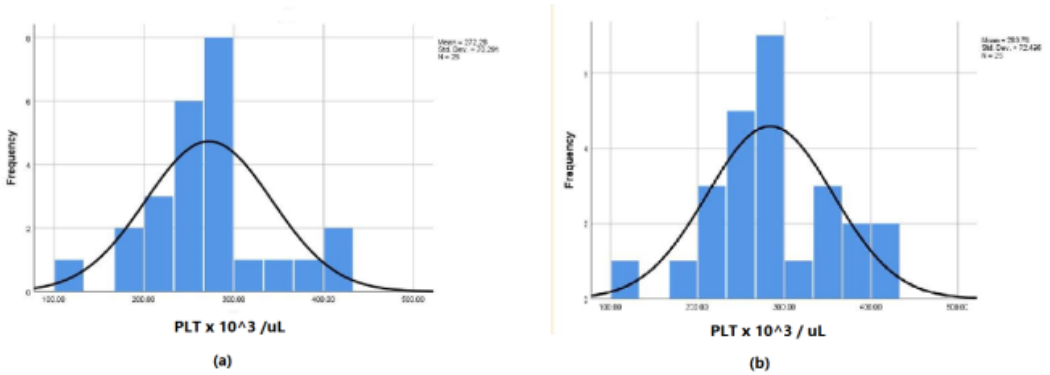

Fig. 2. Histogram of PLT number (a) before applying LLL (b) after applying LLL

of platelet quantity and sometimes obstructing their functions, increased phagocytosis and many other effects [12] From the comparison between the numbers of mono count before and after irradiation, also the increasing in them count, plate late count after irradiated by Low-Level Laser light that because it stimulates cell receptors to increase cell energy production and any time one cell was stimulated to create energy, many other cells will also be stimulated to produce more energy [13,14].

Additional benefits of low level laser therapy include increased protein production, healthy cell growth, wound healing, circulation, tissue regeneration, and immunity. the laser light stimulates the original receptors the receptor stimulates non-laser cells triggering healing responses at the injury site. Histograms that provide graphical representations of the frequency distributions of WBC and PL are before and after exposure the blood sample to LLL are shown in Figure 1 and Figure 2 [15,16].

CONCLUSION

LLL has been applied on the normal human blood for different purposes and it has been shown that LLL had potential influence on the blood components. On the other hand, LLL may also have potential effect on the blood of people with different kinds of cancers.

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