In-vitro Study of Biostimulation Effect on Red Blood Cells Irradiated by 589 nm and 532 nm Low-power Laser

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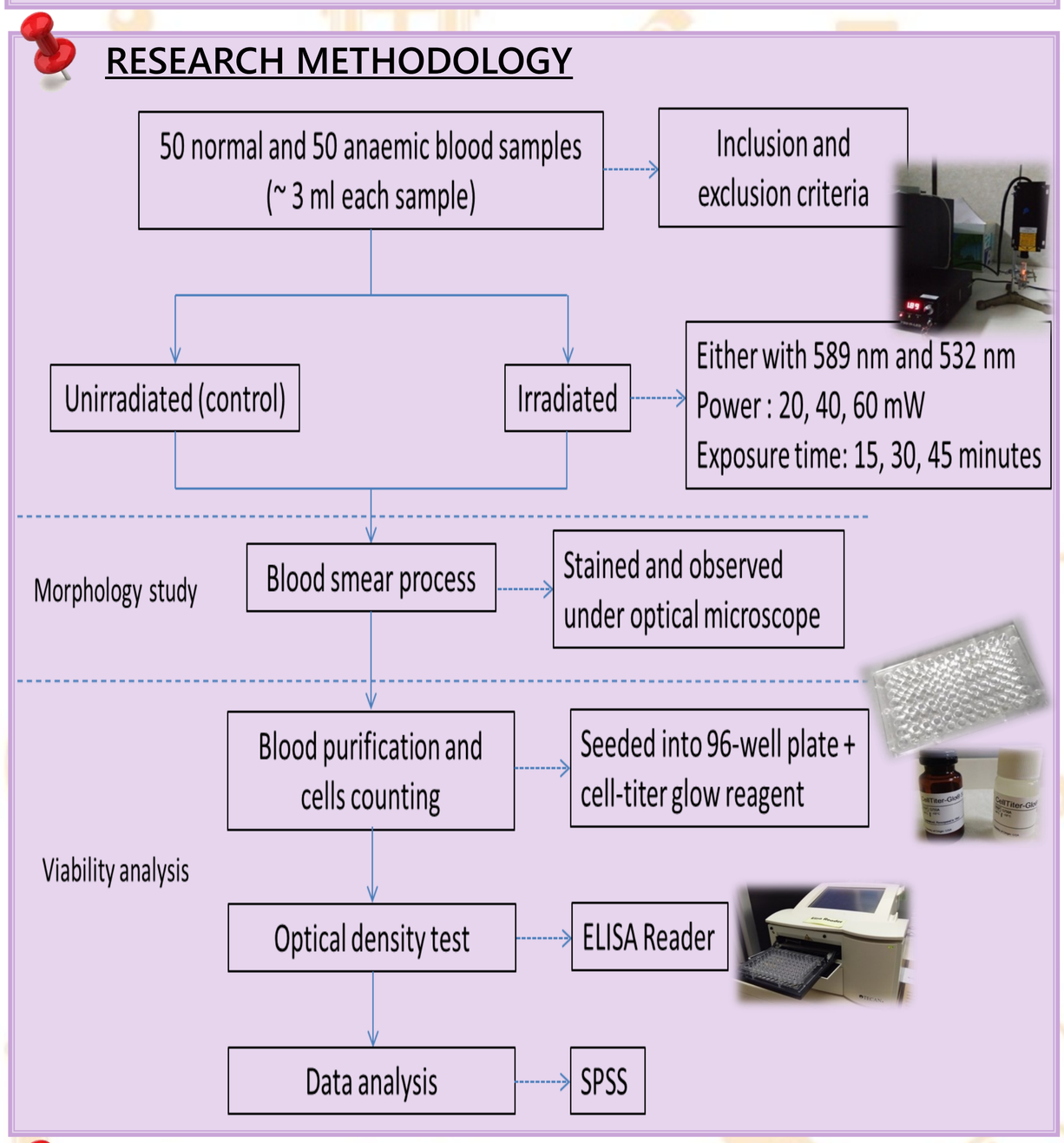
INTRODUCTION

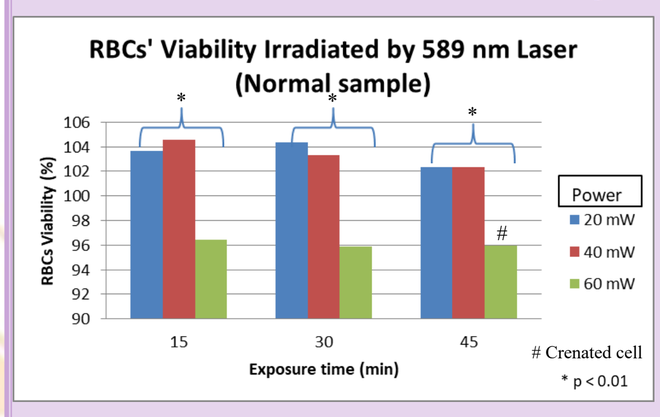
Low-power Laser which applying low output power (1-500 mW) can stimulate cellular processes and enhance biochemical reactions when interact with biological cells or tissues, thus also known as biostimulation. The effects are response to the light, not due to the heat and it use low level technique as the optimum levels of energy density compared to other laser therapy such as ablation, cutting and thermally tissues. Blood, a part of body fluids is heterogeneous fluids contains of 45% cellular components (red blood cells, white blood cells, platelets) and 55% plasma. Red blood cells (RBCs) have thin plasma membrane and enclosed mainly by haemoglobin. Anaemia, is a disease that characterised by low-oxygen transport capacity of the blood that may due to the low red blood count number or lack of haemoglobin content or have abnormality in their morphology. The deformability and viability of RBCs thus give opportunity to have stimulation reaction after laser light interactions and as in RBCs there are presence of haemoglobin that acts as photon absorber. Besides, the laser irradiation is proved in increasing viability of anaemic RBCs compared to the normal RBCs. As there are many studies on the effect of laser irradiation on RBCs and yet many contradict results, thus further study is needed. In this study, the low-power laser of 589 nm and 532 nm is used in order to study the effects of laser on viability and morphology of RBCs and also correlations between them after the laser irradiation.

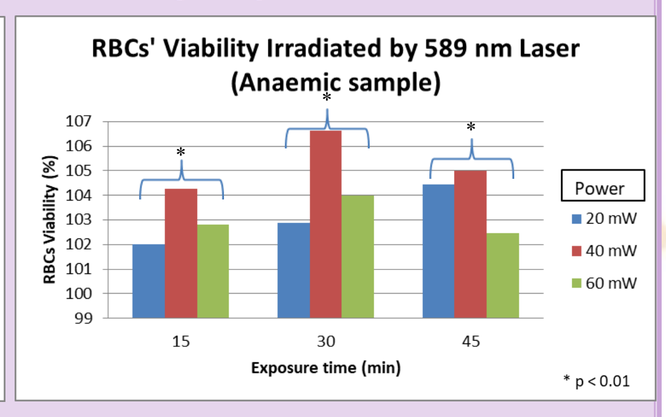
RESEARCH METHODOLOGY

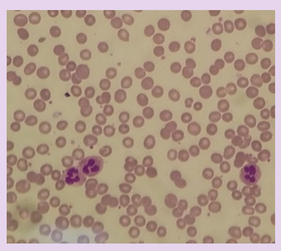


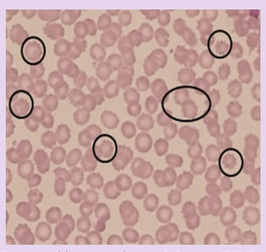
RESULTS

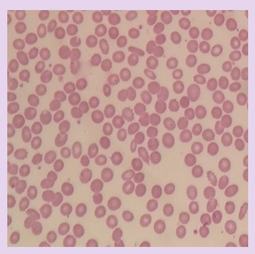
Optical density calculation : $\frac{Optical\ density\ after}{Optical\ density\ before}\ x\ 100\%$






Unirradiated


Irradiated : 60 mW, 45 min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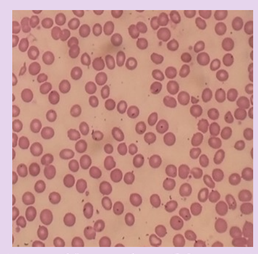
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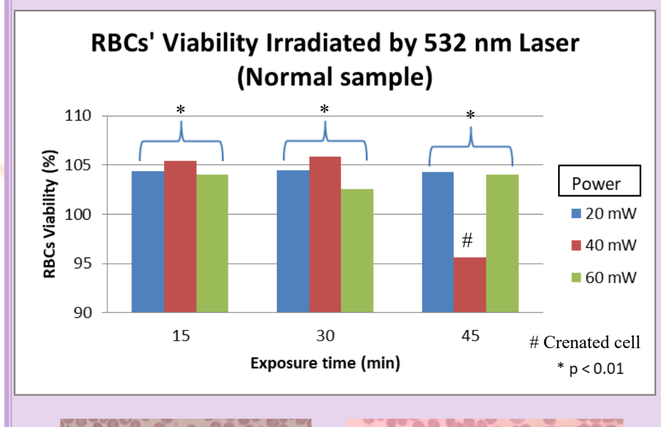

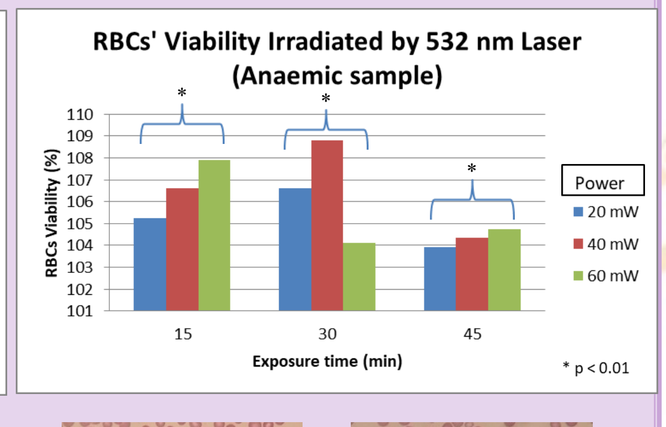

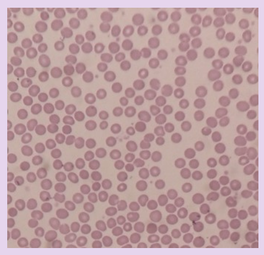
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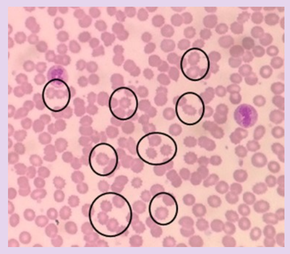
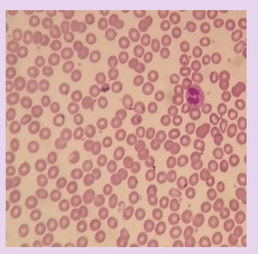

Irradiated : 60 mW, 45 min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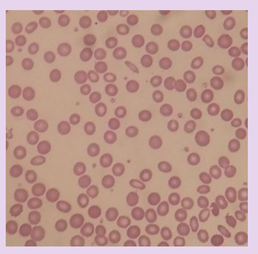
Irradiated : 60 mW, 45 min

DISCUSSIONS

Cell viability show integrity of the outer cell membrane, as it can provide information about cellular and molecular damage of the cells. Due to absence of nuclei and endoplasmic reticulum in RBCs, the extracellular uptake into the cells effect the viability of the cells. The value of 100% of viability is the guideline of RBCs viability, thus showed that if the results are above 100%, the viability is increased while if the results are below 100%, the viability is decreased after the irradiation of low-power laser.

The laser that irradiated into the blood sample thus alter the RBCs membrane, and the deformability of RBCs is depends on deviant osmotic pressure in the change of cell permeability.

The results showed that anaemic blood sample at all power and exposure time increased and maintained the shape after for both laser irradiation compared to the normal sample, which there are some power and exposure time decreased the viability percentage and also the morphology of the RBCs is crenated. This is due to the poor deformability of anaemic blood thus give opportunity of stimulation reaction.

CONCLUSIONS

The statistical analysis of paired t-test of RBCs viability has significant value over exposure time ($p < 0.01$). The anaemic blood sample for both laser has increase the RBCs viability after the laser irradiation also maintained the shape thus showed that viability of RBCs have correlation with the morphology of RBCs.

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