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In vitro Study of Laser Diode Radiation Effect on the Photo-Damage of MCF-7 and MCF-10A Cell Clusters

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Abstract : Breast Cancer is one of the most considerable diseases in the United States and other countries and is the second leading cause of death in women. Common breast cancer treatments would lead to adverse side effects such as loss of hair, nausea, and weakness. These complications arise because these cancer treatments damage some healthy cells while eliminating the cancer cells. In an effort to address these complications, laser radiation was utilized and tested as a targeted cancer treatment for breast cancer. In this regard, tissue engineering approaches are being employed by using an electrospun scaffold in order to facilitate the growth of breast cancer cells. Polycaprolacton (PCL) was used as a material for scaffold fabricating because of its biocompatibility, biodegradability, and supporting cell growth. The specific breast cancer cells have the ability to create a three-dimensional cell cluster due to the spontaneous accumulation of cells in the porosity of the scaffold under some specific conditions. Therefore, we are looking for a higher density of porosity and larger pore size. Fibers showed uniform diameter distribution and final scaffold had optimum characteristics with approximately 40% porosity. The images were taken by SEM and the density and the size of the porosity were determined with the Image. After scaffold preparation, it has cross-linked by glutaraldehyde. Then, it has been washed with glycine and phosphate buffer saline (PBS), in order to neutralize the residual glutaraldehyde. 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromidefor (MTT) results have represented approximately 91.13% viability of the scaffolds for cancer cells. In order to create a cluster, Michigan Cancer Foundation-7 (MCF-7, breast cancer cell line) and Michigan Cancer Foundation-10A (MCF-10A, human mammary epithelial cell line) cells were cultured on the scaffold in 24 well plate for five days. Then, we have exposed the cluster to the laser diode 808 nm radiation to investigate the effect of laser on the tumor with different power and time. Under the same conditions, cancer cells lost their viability more than the healthy ones. In conclusion, laser therapy is a viable method to destroy the target cells and has a minimum effect on the healthy tissues and cells and it can improve the other method of cancer treatments limitations.

Keywords : breast cancer, electrospun scaffold, polycaprolacton, laser diode, cancer treatment
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