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The role of adipose derived stem cells, smooth muscle cells and low intensity laser irradiation (LILI) in tissue engineering and regenerative medicine

Mini-Review

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Abstract: Tissue engineering and regenerative medicine has become the treatment of choice for several degenerative diseases. It involves the repairing or replacing of diseased or damaged cells or tissues. Stem cells have a key role to play in this multidisciplinary science because of their capacity to differentiate into several lineages. Adipose derived stem cells (ADSCs) are adult mesenchymal stem cells that are easily harvested and have the capacity to differentiate into cartilage, bone, smooth muscle, fat, liver and nerve cells. ADSCs have been found to differentiate into smooth muscle cells which play major roles in diseases such as asthma, hypertension, cancer and arteriosclerosis. Low Intensity Laser Irradiation (LILI), which involves the application of monochromatic light, has been found to increase viability, proliferation and differentiation in several types of cells including ADSCs. This review discusses the role of ADSCs, smooth muscle cells and LILI in the science of tissue engineering and regenerative medicine.

Keywords: *Adipose Derived Stem Cells • Smooth muscle cells • Low Intensity Laser Irradiation • Tissue engineering and regenerative medicine*

1. Introduction

Tissue engineering and regenerative medicine is a new multidisciplinary science that combines growth factors, biomaterials and stem cells to repair tissues and damaged organs [1]. Myocardial ischemia as well as cardiovascular disease is becoming a major health problem in developed as well as developing countries, being the third cause of death after cancer and violent deaths. By 2007, in France, 32% of the deaths were caused by cardiovascular disease [2]. Since stem cells have the ability to self renew and differentiate into multiple lineages [3], these cells could be used in cell-based therapy for repairing and regenerating various tissues and organs. Many studies have been done involving LILI and stem cells, both *in vitro* and *in vivo*. Results have shown that LILI can produce negative and positive effects on stem cells. Positive results include inhibition of inflammation and increased cell viability and proliferation [4,5]. Due to ease of isolation and plasticity [6], ADSCs hold great promise for tissue engineering and regenerative medicine [7]. These cells have been differentiated into smooth muscle cells with the help of growth factors and LILI [8].

2. Stem cells

Stem cells have the capacity to proliferate and renew themselves. These cells are able to differentiate into several other cell lineages [9,10]. They are cells that are able to provide replacement for particular differentiated cell types [11]. These cells can divide and renew for a long period. Since they are not specialised and are not matured, they do not carry out specialised tissue-specific functions. Stem cells can only differentiate into one specific type of cell [12-15]. This makes stem cells suitable for repairing and replacing cells in patients. The most commonly used stem cell types are embryonic and adult stem cells [11,16]. Due to resistance towards the use of embryonic stem cells [11,17], as it involves the destruction of embryos

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