Stem cell treatment and its curative value

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Abstract

Stem cell treatments are a type of cell therapy that introduces new cells into damaged tissue in order to treat a disease or injury. Many medical researchers believe that stem cell treatments have the potential to change the face of human disease and alleviate suffering. The ability of stem cells to self-renew and give rise to subsequent generations that can differentiate offers a large potential to culture tissues that can replace diseased and damaged tissues in the body, without the risk of rejection.

Key words: Adult Stem cell, Heart tissue regeneration, Lupus erythematosus, Mesenchymal stem cells, Stem cell therapy, Tooth regeneration.

Introduction

All human beings develop from the union of an egg and a sperm. The result is a fertilized egg or zygote, a single cell that divides into other cells, which together constitute the early embryo these Stem cells are unspecialized cells that develop into the specialized cells that make up the different types of tissue in the human body. They are vital to the development, growth, maintenance, and repair of our brains, bones, muscles, nerves, blood, skin, and other organs. Medical researchers believe that stem cell therapy has the potential to dramatically change the treatment of human disease. A number of adult stem cell therapies already exist, particularly bone marrow transplants that are used to treat leukemia (1). In the medical researchers anticipate being able to use technologies derived from stem cell research to treat a wider variety of diseases. In all current stem cell treatments obtaining stem cells from a matched donor is preferable to using the patients own.

Stem Cell Therapy in Specific Diseases

Heart tissue regeneration
Recent years have seen the emergence of successful adult stem cell treatment for those who have suffered from heart attacks and heart failure. Dr. Andreas M. Zeiher, the chairman of the department of internal medicine and Dr. Stefanie Dimmeler, head of the division of molecular cardiology at the same institution, conducted a study of 28 heart attack patients in 2003 (2). The subjects received a transplantation of their own blood and hematopoietic (blood-forming) stem cells into their heart arteries and average of 4.7 days after their respective heart attacks. Two of the patients experienced difficulties arising from personal arterial conditions. The remaining 26 demonstrated higher levels of heart-pumping capability. The researchers reported that the heart’s ability to pump blood increased from 44.1 percent to 48.9 percent. The report also indicated the average amount of dead tissue for the subjects decreased by 20 percent within four months of the stem cell implantation. In a French study, doctors found that skeletal muscle stem cells taken from a patient suffering from heart disease and implanted back into his heart successfully treated the condition. This was the first adult stem cell treatment that successfully treated cardiac degeneration (3). Another study investigating 14 patients in Brazil showed that there was notable improvement in their heart capacities after implantation of their own stem cells. Scientists stated
that oxygen capacity increased from 17 percent to 24 percent. Similar procedures have been conducted in Europe and Hong Kong. Scientists pursuing stem cell therapy at Germany showed that ten human subjects experienced improved heart regeneration shortly after hematopoietic stem cell transplantation. The cells were extracted from the subject’s body and their own cells given back to each patient, precluding transplant rejection.

**Stem cell therapy for post-polio syndrome**

In post-polio syndrome, it is the end branches of the axons that are dying off while the nerve cell itself may continue living or eventually die. If scientists successfully implant new nerve cells in the anterior horn of the spinal cord can the extend axons and connective end branches out through the tissues to a target muscle fiber. In polio, once muscle fibers have lost their nerve connections they struggle to survive. Muscle fibers typically will atrophy and become non-functional after losing nerve stimulation. Therefore muscle fibers may also need to be replaced. This is much more difficult than implanting new nerve cells in one place such as in Parkinson’s disease or spinal cord injury. Yet there are things that can be done. For example new nerve cells or support cells can be implanted to either fuse into existing weak motor nerve cells or provide protective chemicals for support. This would allow existing motor nerves to function longer and possibly even sprout more. Rodents can be easily engineered genetically and cloned, without implanted cell rejection. Using a mouse as a polio model is a new opportunity to study post-polio rehabilitation with stem cells. The possibility of using this polio mouse model for stem cell studies involving polio is clear, due to the success in using rodents to further the understanding of cell differentiation and the possibilities of stem cell therapy. The most vexing problem for polio survivors may be the speed at which stem cell therapy advancement occurs. The clock is ticking. If rapid advancement in the use of this technology occurs in the next ten years or so, those who had polio in the ’40s and ’50s may benefit. If not, these polio survivors may just miss the next milestone in medicine the ability to regenerate muscle and nerve tissue.

**Haematopoietic stem cell transplantation for lupus erythematosus**

Anecdotal case reports describe individuals undergoing allogeneic hematopoietic stem cell transplantation for hematological disease who subsequently entered durable remission of a coincidental autoimmune disorder (4-8). Intensive immunosuppression and haematopoietic stem cell transplantation has, therefore, been proposed as a therapy for patients with severe autoimmune diseases (SADS), including individuals with systemic lupus erythematosus (SLE) who have poor prognostic features. Allogeneic haematopoietic stem cell transplantation has a higher morbidity and mortality than autologous transplantation, leading consensus conferences addressing the option of high dose therapy for autoimmune disease to recommend the use of autologous stem cells. Purging of lymphocytes from the auto graft has also been recommended since autologous haematopoietic stem cell transplantation, performed for patients with hematological malignancies and a coincidental autoimmune disorder, has been associated with early serological and clinical relapse of the autoimmune disease.

**New tooth**

Tooth development results from sequential and reciprocal interactions between the oral epithelium and the underlying neural crest-derived mesenchyme. The generation of dental structures or entire teeth in the laboratory depends upon the manipulation of stem cells and requires a synergy of all cellular and molecular events that finally lead to the formation of tooth-specific hard tissues, dentin and enamel. Although mesenchymal stem cells from different origins have been extensively studied in their capacity to form dentin in vitro, information is not yet available concerning the use of epithelial stem cells. The odontogenic potential resides in the oral epithelium and thus epithelial stem cells are necessary for both the initiation of tooth formation and enamel matrix production. In this study, epithelial and mesenchymal cells were sequentially seeded into a collagen gel drop and then implanted into the tooth cavity of adult mice. With this technique the presence of all dental structures such as odontoblasts, ameloblasts, dental pulp, blood vessels, crown, periodontal ligament, root and alveolar bone could be observed (9). Thus, the implantation of these tooth germs in the mandible allowed their development, maturation and eruption indicating that stem cells could be used in the future for the replacement of missing teeth in humans. In 2004, scientists at King’s College London discovered a way to cultivate a complete tooth in mice and were able to grow them stand-alone in the laboratory. Researchers are confident that this technology can be used to grow live teeth in human patients. In theory stem cells taken from the patient could be coaxed in the lab into turning into a tooth bud which when implanted in the gums will give rise to a new tooth, which would be expected to take two months to grow. It will fuse with the jawbone and release chemicals that encourage nerves and blood vessels to connect with it. The process is similar to what happens when humans grow their original adult teeth.
Conclusion

Stem cells are a new era of medical history they treat for untreatable disease. If we are to realize the benefits meet the challenges and avoid the risks, stem cell research must be conducted under effective accountable systems of social oversight and control at both national and international levels. Stem cells offer a lot of promise and expectations for developing new cell-based therapeutics. When stem cell research is highly developed, it should treat more complex and non-treatable diseases and save money for poor people.

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