

Wisdom Tooth A Source of Stem Cells

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ABSTRACT

Regenerative medicine has been looking for innovative ways to regrow human tissues that is diseased or damaged from birth defect or injury. They have turned to stem cells for starting material. Researchers have recently discovered a very smart way to use third molars as a source of stem cells that could one day help regrow and repair damaged tissue. Adult stem cells extracted from tissues like skin, bone marrow have certain limitations, since they usually generate only one or two type of cells out more than 200 types in the body.

Keywords : Wisdom tooth and stem cells, stem cell research, stem cell.

INTRODUCTION

The term “ stem cell “ was first proposed for scientific use by the Russian histologist Alexander Maksimov at congress of hematologic society in Berlin in 1908.¹ For most people ,wisdom teeth are not much more an annoyance that eventually needs to be removed. But the wisdom tooth contains a valuable reservoir of tissue for the creation of stem cells. Thus everyone must be carrying his or her own personal stem –cell repository should he or she ever need some.

DISCUSSION

Stem cells are biological cells found in all multicellular organisms, that can divide through mitosis and differentiate in to diverse specialized cell types or can self renew to produce more stem cells. In mammals there two broad type of stem cells namely embryonic stem cells and adult stem cells. embryonic stem cells are isolated from inner cell mass of

blastocyst, while adult stem cells are found in various tissues. In adult organisms, stem cells are progenitor cells which act as a repair system for the body, replenished in adult tissues. In a developing embryo , stem cells can differentiate in to all specialized cells, but also maintain the normal turnover of regenerative organs, such as blood, skin or intestinal tissues.¹

Stem cells can be artificially grown and transformed in to specialized cell types with characteristics consistent with cells of various tissues such as muscles or nerves through cell culture. Highly plastic adult stem cells are routinely used in medical therapies. Stem cells can be taken from a variety of sources , including umbilical cord and bone marrow.^{2,3}

Properties

The definition of a stem cell requires that it possess two properties.

1. Self renewal: The ability to go through numerous cycles of cell division while maintaining undifferentiated state
2. Potency : The capacity to differentiate in to specialized cell types. This requires stem cells to be either totipotent or pluripotent.

Self renew

Two mechanisms exist to ensure that stem cell population is maintained.

- a. Obligatory asymmetric replication: a stem cell divides into one father cell that is identical to the original stem cell and another daughter cell that is differentiated
- b. Stochastic differentiation: When one stem cell develops into two differentiated daughter cells, another stem cell undergoes mitosis and produces two stem cells identical to original.

Potency

Specifies the differentiation potential of the stem cell.⁴

Totipotent: Stem cells can differentiate in to embryonic and extraembryonic cell types. Such cells can construct a complete, viable organism.⁵ The cells produced by the first few divisions are also totipotent.

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Multipotent: Stem cells can differentiate into a number of cells, but only those of a closely related family of cells.

Induced pluripotent: These are not adult stem cells, but rather reprogrammed cells given pluripotent capabilities using genetic reprogramming with protein transcription factors. The pluripotent stem cells equivalent to embryonic stem cells have been derived from human adult skin tissue. The transcription factors used are oct 3/4, sox 2, c-myc, klf 4.⁷

In 2006, Kerkis reported discovery of immature dental pulp stem cells (IDPSC).¹ The dental pulp has mesenchymal stem cells, which has the potential to differentiate into variety of other cell types

1. Cardiomyocytes to repair damaged cardiac tissue following heart attack.
2. Neurocytes to generate nerve and brain tissue
3. Osteocytes to generate bone
4. Myocytes to repair muscle
5. Chondrocytes to generate cartilage
6. Adipocytes to generate fat
7. Bone and tissue from oral cavity.^{10,11}

Researchers in 2006, at Kyoto university in Japan activated genes in adult mouse cells, they could reprogram the cells to resemble the cells of early embryo. The new cells known as induced pluripotent stem cells (ips), which can transform in to any type of human cell. Fibroblasts were reprogrammed from deeper layers of skin to create human ips cells. This proved to be a tough task, as only a tiny percentage of fibroblasts form ips cells. To develop a safe, easy way to tap the source of cells, Hajime Ohgushi MD PhD of the health research institute in Hyogo, Japan turned to extracted wisdom teeth. Ohgushi team obtained mesenchymal stromal cells from wisdom teeth pulled from a 10 yr old, 13 yr old, 16 yr old and grew them in the lab. The soft pulp inside teeth contains cells called 'mesenchymal stromal cells'.¹²

First they showed that these cells can be readily grown in the lab and that these fast growing cells could be quickly reprogrammed, and much more efficiently than skin cells. They reprogrammed the cells by adding 3 or 4 genes that reprogrammed fibroblasts. This resembled human embryonic stem cells, which could morph in to a variety of human tissue types. Ohgushi and colleagues wrote, since human third molars are discarded as clinical waste, the stem cells inside them could be frozen & stored for many years. This makes them a useful source for the generation of ips cells the Japanese team concludes.¹²

Tom Diekwisch Professor of Oral Biology at the University of ILLINOSIS, Chicago found that tooth derived ips cells,

easily formed a tumor called teratoma when implanted in immune deficient mice. Due to cancer risk 'practically its still a little too early' for clinical use says Diekwisch.¹²

Stem cell treatments

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 transplant used in leukemia.⁸ It is also anticipated to treat a wide variety of diseases including cancer, parkinsons disease, spinal cord injuries, multiple sclerosis. One concern of treatment is the possible risk that transplanted stem cells could form tumors and have the possibility of becoming cancerous if cell division continues uncontrollably.⁹

CONCLUSION

The wisdom tooth will one day be considered useful and valuable. According to researchers at National institute of advanced industrial science and technology, the third molar could become an important reserve of stem cells to store in case of emergency.

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