

Tooth Stem Cells-A Saviour of Life : A Review

Dr. Rakesh Kumar Agarwal

Private Practitioner
Civil Lines, Agra-282002 (U.P.)

Dr. Amit Agarwal

Private Practitioner
Civil Lines, Agra-282002 (U.P.)

Dr. Kokil Agarwal

Private Practitioner
Civil Lines, Agra-282002 (U.P.)

Abstract

Stem cell is a generic cell that can make exact copies of itself indefinitely. In addition stem cell has the ability to produce specialized cells for various tissues in the body. Stem cell treatment using special human cells to repair or replace damaged tissues or organs is the cornerstone of future medical sciences.

Key Words: Tooth stem cells, Cardiomyocytes, Osteocytes, Chondrocytes, Adipocytes, Stem cell banking

Introduction

Human teeth have been identified as a rich source of stem cells and have the potential of treating some of the worst illnesses such as Parkinson's and Huntington's disease. Earlier tests have shown the ability of dental pulp stem cells of being able to aid in regrowth and restoration of craniofacial and dental cells.

Studies show that dental stem cells can develop into tissue types complementary to those derived from umbilical cord blood, such as bone, other connective tissues, and possibly even neural tissue, among others.

Dental & Nondental Aspects of Tooth Stem Cells

Scientists have identified 4 dental stem cell components in dental pulp i.e. mesenchymal, neural, vascular and a precursor to these like embryonic cells. These type of stem cells have the future potential to differentiate into a variety of other cell types including

- Cardiomyocytes to repair damaged cardiac tissue after heart attack
- Neuronal cells to generate nerve and brain tissue
- Myocytes to repair muscles
- Osteocytes to repair bones
- Chondrocytes to generate cartilage
- Adipocytes to generate fat
- Dentine
- Pulp

A team of dentists at Emory university conducted experiment by using dental pulp stem cells from extracted teeth of Rhesus monkey known as Rhesus macaque; and then directly implanted them into hippocampus of mice. This resulted in a greater formation of neurons and at the same time increase in stimulation of growth of new neural cells. This experiment broadens the horizon for therapeutic purpose of dental stem cells.

Nowadays scientists are using dental stem cells to create an entirely new teeth, as replacements for teeth that have been lost. Other applications which are likely include regeneration of healthy pulp after root canal treatment or growth of bone grafts for treatment of periodontal diseases.

Nondental aspects include bone and joint repair and treatment of muscular dystrophy. Dental pulp can provide neurotrophic support and appear to differentiate into neurons in vitro with possible implications for the future treatment of Parkinson's disease and other neurological disorders. As an example application, implantation of these cells into immunocompromised rats leads to creation of a tissue structure with an integral blood supply similar to that of human adult bone. Dental stem cells have also been studied models for plastic surgery such as facial wrinkles.

The easy method of isolation of dental stem cells at any age by a single visit to the dentist is a prime indication of dental stem cell banking.

Procedure of Dental Stem Cell Banking

All dental stem cells operate with stringent regulatory guidelines and ensure to constantly maintain their standards.

Step 1: Tooth Collection : This is carried by the local dentist. The extracted tooth is placed in tooth collection kit and dispatched to the lab. The sample should reach the lab within 48hrs so as to maximize chances of successful isolation of valuable stem cells.

Step 2: Stem Cell Isolation : Cellular material is obtained from the sample. After cell isolation their health and viability are confirmed.

Step 3: Tooth Cell Storage: Once a guaranteed number of viable uncontaminated cells are ensured they are cryogenically stored.

Benefits of Dental Stem Cell Banking

- Easy, painless, quick method and has no ethical complication
- They are body's own cells so a perfect match
- Can be used for both dental and nondental treatments
- Unlike umbilical cord which have to be extracted soon after birth dental stem cells can be extracted later

Discussion

While this research is still in early stages the future benefits have persuaded many

families to save these cells instead of just throwing them away. Researchers show that deciduous teeth from 6-10 year old patients as well as adult teeth from 30-45 year old patients contain dental stem cells that can be cryopreserved.

Dental stem cell banking is a new revolutionary concept. It is a simple, easy and painless way of collecting and storing stem cells from milk teeth and wisdom teeth.

Storing your child's dental stem cells is the ultimate protection you can provide to your child.

In summary, the dental stem cells may lead to new clinical applications in both dentistry and medicine

Dental stem cells are being investigated by researchers around the world including in the USA, UK, Italy, Australia, France, Brazil, Korea, China, Japan.

In India these dental stem cell banks have been established in Mumbai and Delhi.

References

1. Shi S, Bartold PM, Miura M, Seo BM, Robey PG, Gronthos S. (2005). The efficacy of mesenchymal stem cells to regenerate and repair dental structures. *Orthod Craniofac Res.* 8(3):191-9
2. Batouli, S., Miura, M., Brahim, J., Tsutsui, T.W., Fisher, L. W., Gronthos, S., et al. (2003). Comparison of stem cell mediated osteogenesis and dentinogenesis. *J Dent Res.* 82(12):976-981
3. Gronthos, S., Brahim, J., Li, W., Fisher, L.W., Cherman, N., Boyde, A., DenBesten, P., Robey, P.G., Shi, S. (2002). Stem cell properties of human dental pulp stem cells
4. Gotlieb EL, Murray PE, Namerow KN, Kuttler S, Garcia-Godoy F. (2008) "An ultrastructural investigation of tissue-engineered pulp constructs implanted within endodontically treated teeth." *J Am Dent Assoc.* 139(4):457-65
5. Cordiero et al. (2008) "Dental pulp tissue engineering with stem cells from exfoliated deciduous teeth." *J Endod.* 34(8):962-969
6. d'Aquino et al. (2008) "Dental pulp stem cells: a promising tool for bone regeneration" *Stem Cell Rev.* 4(1):21-
7. Kerkis et al. (2008) "Early transplantation of human immature dental pulp stem cells from baby teeth to golden retriever muscular dystrophy (GRMD) dogs: local or systemic?" *J Transl Med.* 6(1):35
8. Huang et al. (2008) "Putative Dental Pulp Derived Stem/Stromal Cells Promote Proliferation and Differentiation of Endogenous Neural Cells in the Hippocampus of Mice." *Stem Cells.*
9. Gronthos, S., Mankani M, Brahim J, Robey P.G & Shi S. (2000). Post natal human dental pulp stem cells (DPSCs) in vitro and in vivo. *Proc Natl Acad Sci USA.* 97(25), 13625-13630
10. Batouli S, Miura M, Brahim J, Tsutsui T W, Fisher L W, Gronthos S, et al (2003). Comparison of stem cell mediated osteogenesis and dentinogenesis. *J Dent Res.* 82(12), 976-981.