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Guest Editorial

Stem Cells for Dental Tissue Regeneration

For centuries, scientists have known that certain animals can regenerate missing parts of their bodies. Although we cannot replace a missing leg or a finger, our bodies are constantly regenerating blood, skin, and other tissues. The identity of the powerful cells that allow us to regenerate some tissues was first revealed when experiments with bone marrow in the 1950s established the existence of stem cells in our bodies and led to the development of bone marrow transplantation, a therapy now widely used in medicine. This discovery raised hope in the medical potential of regeneration. For the first time in history, it became possible for physicians to regenerate a damaged tissue with a new supply of healthy cells by drawing on the unique ability of stem cells to create many of the body's specialized cell types. Tooth formation results from epithelial-mesenchymal interactions. Thus two different populations of stem cells have to be considered:

Epithelial stem cells (EpSC), will give rise to ameloblasts. Depending upon the source of isolation, these may further be of following two types:

(i) Epithelial stem cells from developing molars
(ii) Epithelial stem cells from the labial cervical loop of rodent incisor

Mesenchymal stem cells (MSC) will form the odontoblasts, cementoblasts, osteoblasts and fibroblasts of the periodontal ligament. These are of various types namely:

a. EPITHELIAL STEM CELLS (EpSCs)

i) Epithelial stem cells from developing molars
ii) Epithelial stem cells from the labial cervical loop of rodent incisor

b. MESENCHYMAL STEM CELLS (MSCs)

i) Stem cells from human exfoliated deciduous teeth (SHED)
ii) Adult dental pulp stem cells (DPSC)
iii) Stem cells from the apical part of the papilla (SCAP)
iv) Stem cells from the dental follicle (DFSC)
v) Periodontal ligament stem cells (PDLSC)
vi) Bone marrow derived mesenchymal stem cells (BMSC)

The challenge that remains is to find out new and easily accessible sources of both epithelial and mesenchymal stem cells that can be reprogrammed for an odontogenic potential and then associated to form a fully functional tooth. One alternative could be the use of genetically modified cells expressing specific genes (e.g. transgenes) or with a specifically deleted gene (e.g. knock-in, knock-out). Ideally, this approach should provide a non-limited source of cells and introduce new genetic information to reprogram a non-dental cell to acquire odontogenic properties. Although this technique provides us with an unlimited source of epithelial cells and shows the potential of genetically modified cells that can be used for tooth engineering, many questions have still been left unanswered: Which gene should be used to trigger an odontogenic program? Is only one gene enough to reprogram a cell toward a tooth specific cell? Such and many more queries keep popping up every time a regenerative experiment is instituted.

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