

Human Dental Pulp Stem Cells: Applications in Future Regenerative Medicine

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Description

Stem cells are unspecialized cells having a property of self-renewal and further differentiate into various kinds of specialized cells.

Stem cells are identified during variety of adult tissues including skin, adipose tissues, peripheral blood, bone marrow, pancreas, intestine, brain, hair follicles, also as within the dental pulp cells.

Stem cell research has expanded well because of their usefulness in regenerative therapies for improving the lifetime of patients suffering from various genetical and neurological diseases. Studies have shown that the dental pulp tissue also can be utilized to derive mesenchymal stem cells (MSCs) when tissue is grown in culture.

DPSCs are considered as cranial neural crest cells (CNCCs).

DPSCs are effective on various diseases, like spinal cord injuries (SCIs), Parkinson's disease (PDs), Alzheimer's disease, cerebral ischemia, myocardial infarction, dystrophy, diabetes, liver diseases, eye diseases, immune diseases, and oral diseases.

The other varieties of human dental pulp-derived stem cells (HDPSCs) include dental pulp of human exfoliated deciduous teeth, root apical papilla of human teeth, and dental pulp of human supernumerary teeth, i.e., stem cells from human exfoliated deciduous teeth (SHED), stem cells from apical papilla (SCAP), and human supernumerary tooth-derived stem cells (SNTSCs).

Properties of human dental pulp- derived stem cells

The HDPSCs properties are similar with mesenchymal stem cells. The properties of HDPSCs include:

- Multipotency
- High proliferation activity
- Self-renewal capacity
- In vivo tissue regeneration capacity
- Colony-forming unit-fibroblasts forming ability
- Expression of cell-surface markers
- Immunomodulation
- Molecular marker's for DPSC's

Stem cell markers

Several molecular markers are established to spot specific cell type. Multiple investigators have already established various markers but there are few types of markers which tell us their phenotypes, pluripotency status and differentiating characteristics. Dental pulp cells also should be characterized by such kinds of markers, varieties of them are as follows:

- Mesenchymal somatic cell markers
- Hematopoietic somatic cell markers
- Pluripotency markers
- Differentiation markers

Applications

Dental pulp vegetative cell s (DPSCs) has great potential for a spread of applications in somatic cell research and regenerative medicine. The varied uses of HDPSCs supported recent studies with respective tissue regenerative capacity, multi-potency, and immunomodulatory factors are as follows:

Tissue engineering

- **Regeneration of dentin/pulp complex:** The regeneration of dentin pulp complex is predicated on vascularization. Vascular endothelial protein administration promotes vascularization but features a brief half-life. This will be increased by binding to heparin. Autologous transplantation of DPSCs has clinically tried to regenerate the dentin-pulp complex.
- **Periodontal regeneration:** It is an alternate source within the treatment of periodontal diseases.
- **Root regeneration:** It is considered to include root growth in the tooth development. The regenerated tooth root like structure works functionally as masticatory organ likely natural porcine teeth.
- **Bone regeneration:** An evaluation on bone regeneration by DPSCs both clinically and radiographically, employing a collagen scaffold, their results showed that within 3 months of colonization on the scaffold, complete radiographic bone regeneration may be observed.
- **Tooth regeneration:** Histological analysis showed that the pattern of tissue-engineered odontogenesis was almost like that of natural tooth development with significant regeneration of enamel, dentin, and cementum.

Cell transplantation

The cell transplantation of HDPSCs has efficiency in various diseases like:

- Central systema nervosum
- Parkinson's
- Alzheimer's
- Retinal injury
- Peripheral nerve injury

- Autoimmune diseases
- Bone diseases
- Liver diseases
- Diabetes
- Infertility

It also serves as cell bank for human dental pulp-derived stem cells.