



Tooth-derived stem cells: update and perspectives

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focus on

By Sara Colombo

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Tissue engineering involves an interactive triad of scaffolds, signalling molecules, and cells.

Scaffolds are used as a three-dimensional template mimicking the extracellular matrix; signalling molecules enhance this cellular activity by stimulating cells to migrate, proliferate and differentiate; cells synthesise the extracellular matrix and tissue regeneration. The goal is to harvest, grow and improve stem cells for regenerating other tissues.

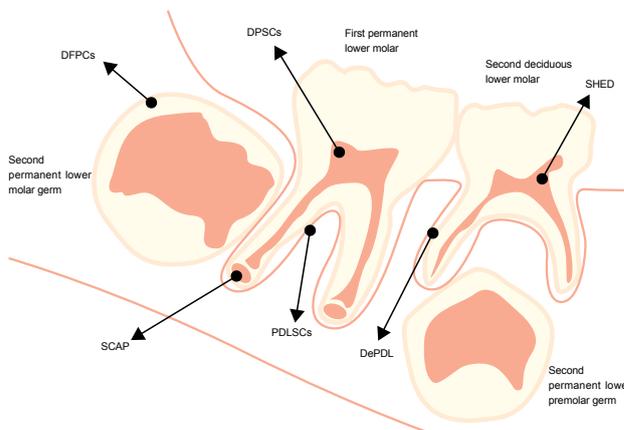
But what does “stem cell” mean?

Stem cells (SCs) are able to continuously self-renew and can be induced to differentiate into multiple specialised cell types. SCs can be isolated in the earliest stages of embryogenesis (embryonic SCs) or in various postnatal tissues (adult SCs). Because of the embryo destruction, only adult SCs can be studied.

In the medical field, mesenchymal SCs (MSCs) have been widely studied for their promising therapeutic potential. Typically, MSCs are taken from bone marrow and their isolation entails surgery.

Considering the advantages to isolate SCs from easily accessible tissues, dental tissues have been investigated as niches of MSCs, with a special focus on non-invasive source of the cells for investigation of paediatric diseases. Tooth-Derived Stem Cells (TDSCs) are the following.:

- DPSCs (dental pulp stem cells): extracted third molar or teeth for orthodontic treatment, trauma or periodontal disease are all sources of dental stem cells from dental pulp. These cells are more proliferative than BMSCs. *In vivo* clones differentiate into dentin-like structures.
- SHED (human exfoliated deciduous): SCs from exfoliating deciduous teeth have been found to grow more rapidly than those from other sources. They show high capability for osteogenic and adipogenic differentiation and can also differentiate in neural cells.
- SCAP (apical papilla): this tissue is associated with root formation and it may provide a source of MSCs for this



purpose.

- DFPCs (dental follicle progenitor cells): dental follicle is a condensation of ectomesenchymal cells which can produce periodontal ligament, cementum and alveolar bone.
- PDLSCs (periodontal ligament): some clones form periodontal ligament and cementum-like structures *in vivo*.
- DePDL (periodontal ligament of deciduous teeth): it is more proliferative than the permanent counterparts producing ligament and cementum-like structures.

Science fact or fiction?

Research on cell therapy for regenerating dental tissues has already been done and shows promising results; cell therapy will be the next generation of dental medicine. Nevertheless, further research is needed to better characterise TDSCs and to understand their differentiation pathways.



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