

Dental Stem Cells in Tissue Engineering for Dental Regeneration

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ABOUT THE STUDY

In recent years, there has been a growing interest in the field of regenerative medicine, particularly in tissue engineering and stem cell-based therapies. Stem cells have the remarkable ability to differentiate into various cell types and hold great promise for repairing and regenerating damaged tissues. In dentistry, dental stem cells have emerged as a valuable resource for tissue engineering applications. This article aims to explore dental stem cells and their importance in dental tissue engineering, highlighting their potential for dental regeneration and the challenges in harnessing their full therapeutic potential.

Dental stem cells

Dental stem cells are a type of Mesenchymal Stem Cells (MSCs) found within the dental tissues. They are derived from various dental sources, including the dental pulp, periodontal ligament, dental follicle, apical papilla, and exfoliated deciduous teeth. These dental tissues are routinely discarded after tooth extraction or during orthodontic procedures, making them easily accessible and non-invasive sources of stem cells.

Importance in dental tissue engineering

Dental stem cells hold significant potential for dental tissue engineering due to their unique properties. These cells can differentiate into odontoblasts, osteoblasts, adipocytes, and chondrocytes, which are essential for the regeneration of dental tissues such as dentin, bone, adipose tissue, and cartilage.

Dentin regeneration

Dental stem cells can differentiate into odontoblast-like cells, which are responsible for the formation of dentin, the hard tissue underlying the enamel. Dentin regeneration is of great importance in cases of dental caries, trauma, or dental procedures that involve the removal of a significant amount of tooth structure. Dental stem cells can be utilized to regenerate dentin, promoting the repair and preservation of natural tooth structure.

Bone regeneration

Dental stem cells also possess the ability to differentiate into osteoblasts, the cells responsible for bone formation. This property makes them ideal for bone regeneration in cases of alveolar bone loss, which commonly occurs following tooth extraction or periodontal disease. Dental stem cells can be used to engineer bone grafts or promote the regeneration of new bone tissue, enabling the successful placement of dental implants and restoring the aesthetics and functionality of the oral cavity.

Periodontal tissue regeneration

Periodontal disease, a common oral health condition, leads to the destruction of periodontal tissues, including the periodontal ligament and cementum. Dental stem cells derived from the periodontal ligament hold immense potential for regenerating these tissues. By differentiating into periodontal ligament fibroblasts and cementoblasts, dental stem cells can aid in the regeneration of periodontal tissues, promoting the reattachment of teeth and preventing tooth loss.

Challenges in dental tissue engineering

While dental stem cells offer exciting prospects for dental tissue engineering, several challenges need to be addressed for their effective clinical translation:

Cell isolation and expansion: Obtaining an adequate number of viable stem cells for tissue engineering can be challenging. The isolation and expansion of dental stem cells require specialized laboratory techniques and can be time-consuming and costly. Optimizing and standardizing cell isolation protocols are essential to ensure the availability of a sufficient number of cells for therapeutic applications.

Scaffold selection: Dental stem cells need a suitable three-dimensional scaffold to support their growth, proliferation, and differentiation. The scaffold provides a framework for cell attachment, migration, and tissue formation. Selecting the

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appropriate scaffold material with the right physical and chemical properties is crucial to creating a conducive environment for dental stem cell differentiation and tissue regeneration.