



STEM CELLS IN DENTISTRY**DEVI MS^{1*}, MANJU J², RAHUL B³ AND DEVI TD⁴****1:** Senior Lecturer, Madha Dental College and Hospital, Chennai**2 & 3:** Senior Lecturer, Thai Moogambigai Dental College and Hospital, Dr. M.G.R

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4: Private Practitioner, Imphal***Corresponding Author: Dr. Mutum Sangeeta Devi: E Mail: mutumsangeeta21@gmail.com**Received 25th Nov. 2020; Revised 29th Dec. 2020; Accepted 10th Jan. 2021; Available online 1st Oct. 2021<https://doi.org/10.31032/IJBPAS/2021/10.10.5661>**ABSTRACT**

Stem cells are distinctive cells that have the ability to grow rapidly and have the capacity to evolve throughout the body into special types of cells. In dentistry, stem cell-based therapies could assist in new developments in the treatment of damaged teeth, inducing bone regeneration, and even making it possible for a biological tooth. Stem cells have the ability to self-renew and give rise to a range of cells that guarantee lifelong tissue repair and regeneration. Several adult stem cell groups have been isolated from dental and periodontal tissues over the past decades, which is tested for their possible regenerative dental applications. Numerous stem cell-based treatment methods and techniques that could be translated into dental practice and revolutionise dentistry are briefly discussed here.

Keywords: Stem cell, Dental stem cells, Regeneration, Dentistry**INTRODUCTION**

Stem cells are very special cells that have the ability to grow into many different types of cells, supporting the body as a repair mechanism. Each cell has the ability to remain as a stem cell or to become another type of cell with a more specialised role when a stem cell divides. The three

general properties of all stem cells are the same as self-renewal, un-specialization and limitless power [1]. Stem cells are undifferentiated cells that are capable of proliferation, self-maintenance, development of various specialised cells, tissue self-repair from injury, and the capacity to grow in the

body into a variety of cell types, via self-renewal, stem cells replicate [2, 3].

Two basic types of stem cells are defined according to their capacity for differentiation: embryonic stem cells (ESC) and adult stem cells ([ASC] or Mesenchymal stem cells (MSC). Comparing to both stem cells, ASC is a more favourable cellular source for use in tissue engineering. Several tissues, like brain, skin, hair follicles, skeletal muscle, bone marrow and dental tissues, have been isolated [4].

Dental stem cells –

In various dental tissues, dental stem cells have recently been identified, such as human exfoliated deciduous teeth stem cells, periodontal ligament stem cells, dental pulp stem cells, while apical papilla stem cells are found in wisdom teeth dental papilla, and researchers have named stem cells found in dental follicles to produce wisdom teeth as dental follicle precursor cells [5-12].

Advantages

- They are conveniently available and have a simple and least invasive way of getting them.
- Stem cell banking is a sensible and fast alternative to stem cell harvesting.
- They illustrate outstanding contact with scaffolds.

- They have a high propensity for proliferative and multi-differentiation [13-15].

Dental stem cell banking

For potential uses, cell preservation technology has made it possible to preserve important stem cells. For years, stem cell banking has worked, and it is now in use to retain stem cells by banking umbilical cord blood. It provides another source of stem cell banking by finding stem cells in deciduous teeth and wisdom teeth.

There are three steps involved in stem cell banking like collection of teeth, isolation of stem cells and storage of tooth cells. The cells are conserved at a temperature of less than -150 °C in liquid nitrogen vapour. This will retain and maintains the potential strength of the cells [16].

Application in dentistry

Pulp Regeneration

Regeneration of dental pulp will alter the existing trend of replacing polluted pulp with inorganic materials. Stem cells from Human Exfoliated Deciduous Teeth SHEDs and Dental Pulp Stem Cells (DPSCs) are the best dental cell sources if the objective is to regenerate dental pulp, based on the characteristics of cell sources. For this reason, the protocol developed by researcher consists of isolating DPSCs and SCAPs from human third molars, covering these cells with a copolymer matrix and injecting the mixture into the already

cleaned canal space. A study has been conducted in mice to test this procedure and found that the root canal was fully filled with very well vascularization of pulp tissue after 3-4 months, and even a continuous layer of tissue similar with mineralized dentine was formed over the existing dental walls in the canal [17].

Periodontal Regeneration

Latest studies have shown that implantation of DPSCs in periodontal diseases of dog's results in the regeneration of well-formed mature bones with neovascularisation. One human clinical research tested autologous DPSCs for the treatment of alveolar bone abnormalities collected from maxillary third molars and then mixed with a collagen sponge scaffold. The full regeneration of damaged bone at the site of injury resulting in the filling of this bio complex in the space created by extraction of the mandibular third molar, indicating DPSCs as a possible cell source for periodontal regeneration [17, 18, 19]. Since Periodontal Ligament Stem Cells (PDLSCs) were first shown to repair periodontal defects in rat mandibles, numerous studies have been carried out to explore the possibility of using PDLSCs in several larger animal studies to treat periodontal diseases. Miniature swine autologous PDLSCs have been extended ex vivo and labelled with green fluorescent protein (GFP). These cells were then

transplanted into periodontal defects in combination with HA-TCP, and GFP-labelled cells were detected in the newly developed bone with regenerated cement and PDL in the defect areas [20, 21, 22].

Stem cells and apexogenesis or apexification

Stem cells already existing in essential pulp tissue, apical papilla, PDL, or alveolar bone may result in tissue regeneration into the apex of the immature permanent tooth; stem cells and growth factors seeded on scaffolds may alternatively be used to regenerate tissue in vitro or in vivo. Endodontic treatment requires the removal of residual pulp tissue to the level of the growing root apex, i.e., at its loose physical relation with the apical papilla, if infection spreads across the root canal system. Radiographs, apex locators, tactile sensation and reproducible drying points are driven by clinicians, but it is difficult to know where the pulp tissue ends and whether all pulp cells are extracted. As suggested by case reports showing immature teeth with pulpal necrosis undergoing apexogenesis, immature permanent teeth have a rich cellular and vascular supply, so DPSC and SCAP can survive disinfection. Using tooth slices injected into mice, revascularization following pulpal severing was studied in vitro. Applying angiogenic growth factors greatly improved vascular sprouting,

stressing the role of the environment in favourable healing. Histologically, vital tissue has been shown following revascularization procedures inside the root canal space, but the origin of this tissue remains unproven [23-26].

Dentin regeneration

In the damaged locations, the DPSCs migrate, proliferate, and differentiate into odontoblasts, which then synthesise matrix on scaffolds to form tertiary dentin [27].

Repair and replacement of bone in craniofacial defects

Procedures for craniofacial bone grafting rely on autologous bone grafting, devitalized allogeneic bone grafting, and osteoconductive natural/synthetic biomaterials. Autologous bone grafting is restricted by the morbidity of the donor site and allogeneic bone is most easily killed. A long-term result using biomaterials depends on their ability to enable local cells to regenerate a defect completely and findings are often not encouraging. If stem cells can still be harvested and transplanted into a defect in a scaffold to restore the missing tissue, several problems associated with conventional procedures can be alleviated.⁴

CONCLUSION

The most promising solution for effective regeneration of weakened or pathological dental tissues or even the entire tooth following tooth loss is stem cell-based therapies. Therefore, it is important to

understand the specific mechanisms underlying the ability of the different populations of dental stem cells and their actions in ectopic locations after transplantation. Despite the rapid developments in the fields of developmental biology and regenerative medicine, before tooth regeneration in dental practise is a reality, more research is still needed. We need a more detailed understanding of the processes of tooth initiation and the features of dental stem cells, in particular.

Financial Support and Sponsorship- Nil.

Conflicts of Interest- There is no conflict of interest.

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