REVIEW ARTICLE

An Assiduous Insight on Stem Cells in Dentistry

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ABSTRACT

Beetling lunges have been noted in the domain of dentistry for the last couple of decades. Amongst them, the most prominent and promising are the study and application of stem cells for the purpose of repair and regeneration. Considering the fact that dental stem cells are easy to obtain and manipulate, it could lead to a remarkable treatment option to heal any pathology in pulp, periodontium or tooth structure. The applications could bring about a revolution in the field of dental sciences if used appropriately and judiciously.

KEYWORDS: Stem Cells; Dentistry; Innovation; Pulp; Periodontium

INTRODUCTION

Currently, a colossal problem faced by the Industry of medicine and science is in the context of degeneration and severe irrevocable loss of human tissues. In spite of multitudinous prosthetic substitute alternatives and viable contingency strategies, it is vital that a feasible option in the form of regeneration of the exact same tissue is made available. This led to the development of the concept of stem cells, which so far has shown pragmatic results. The most distinctive characteristic of the stem cells is the potency to categorize and divide into vivid cell types. The majority of the stem cells are non-differentiated and have ranged from embryonic kind to the adult variety. They have the spectacular propensity to differentiate into any form of particular and specific kind of tissue cells. Stem cells were primarily procured from the blastocysts of rats in the year of 1980. However, the human embryonic cells were procured for the very primary time in the year of 1998.[1] Ever since the coining of the terminology of stem cells in the early 1900s, there has been timely progressed with a major breakthrough in the form of the discovery of the procurement of dental pulp stem cells by Dr. Irina Kerkis[2.] This has been followed by the specific acknowledgment of the mesenchymal stem cells in pulp which has an enormous potential of regeneration[3]. Stem cells have been broadly categorized on basis of the potency in Table 1

1.	Totipotent
2.	Unipotent
3.	Pluripotent
4.	Multipotent
5.	Self-renewal

TABLE 1 – Classification based on potency

- Totipotent-Stem cells: Cells with the capability to process all forms of cells and its sub-kinds.
- Unipotent-Stem cells: The ones which have the potency to produce any one type of cell.
- Pluripotent-Stem cells: Cells of all forms could be processed except the embryonic nature.
- Multipotent-Stem cells: Cells may process into multiple types of cells.
- Self-renewal Stem cells: This kind formulates a ceaseless repository of cells.

TYPES OF STEM CELLS

Classification has also been categorized as:

- Embryonic Stem Cells
- Adult Stem Cells

Embryonic Stem Cells: A derivative from blastocysts with an exceptional totipotent capability to differentiate into more than 200 different types of cells is referred to as the embryonic stem cell. One of the fascinating characteristics of these varieties is the potential to stay undifferentiated in all extreme conditions for a very long period of time which leads to ease of storage. However, a vital ethical cogitation has been employed in recent years regarding the procedure of procuring such embryonic stem cells from an embryo. Also, scientific implications and limitations have been recognized considering the exponential uncontrolled differentiation leading to the embodiment of teratoma.[4]

Adult Stem Cells: A non-totipotent derivative group of undifferentiated cells found in the sites called niches, usually present in the blood, pancreas, muscle and tooth pulp amongst others. The group has been further categorized as hematopoietic cells and mesenchymal cells.[5] Using vivid pathways either in the form of Notch pathway or WNT pathway, a multitude utilization for replacement of dead tissues as well damaged tissues have been achieved. However, a significant roadblock in the procuring of the adult stem cells is the arduous condition required to maintain the cells in the undifferentiated form.

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Stem cells in dental tissues can be procured from three types of tooth:

1) **Permanent Teeth**: Any healthy permanent teeth serves as an incredible source of profuse stem cells. Permanent teeth which may be removed for a number of reasons including orthodontic serial extractions, a sound tooth removed due to impingement on soft tissues or any related conditions could be used to extract the stem cells. However, any pulpal pathology, periodontal extensive defects, oral infections could deplete the source of stem cells and hence any such pathological tooth should be refrained from utilization.
2) **Deciduous Teeth**: With similar methods and approaches employed in the permanent teeth, deciduous teeth also serve as a core source of profuse dental based stem cells. The proliferation and differentiation potential of the stem cells derived from deciduous teeth have been found to have a similar effect as the ones derived from the permanent teeth.
3) **Wisdom Teeth**: In adults, the availability of stem cells is extensive in the impacted teeth. If the tooth is non-carious and non-pathological, the impacted teeth can be disimpacted during which the pulp is used to extirpate the stem cells from it. Moreover, if the surgical approach is utilized for the removal of a 3rd molar, it would expose the pulp tissue which helps in the isolation process.

PERIODONTAL REGENERATION USING STEM CELLS

Significant challenge associated with the regeneration of the periodontium is that it is highly arduous to predict the outcome. Damage to the periodontal tissues is majorly due to the inflammation referred to as periodontitis which leads to loosening of the supporting tissues which involves periodontal ligament, cementum, and alveolar bone[6]. Primarily, the repair was initiated with scaling and root planning followed by some surgical procedures and the maintenance phase. Moreover, treatment options have enhanced by the availability of growth factors like epidermal and fibroblastic and BMP growth factors.[7]

A novel proposition is to consolidate all the progenitor cells at the local site of periodontal defect or degeneration.[8] This has shown some fairly positive results. A rich reservoir of the pluripotent stem cells can be observed in the form of dermal fibroblasts. This cells derived from bone marrow and adipose tissue have the ability to cause a chain of events leading to complete renewal and regeneration of the periodontal ligament as well as the crest of the alveolar bone.[9] It has been validated by the series of studies by Kawaguchi and his associates that such cells have the utmost potential resulting into the regeneration of PDL, cementum and alveolar bone in dogs. A similar study in humans showed close results as well.[10]

PULPAL REGENERATION USING STEM CELLS

Dental pulp can be distinct as a vascularized tissue in the tooth structure that provides nutrition to overlying highly mineralized structures like the enamel, dentin, and cementum along with maintaining the blood supply of the tooth.[11] Conventional techniques for treatment of the pulp involves direct and indirect pulp capping, pulpotomy and pulpectomy. Stem cells have showing immensely positive results for the pulpal regeneration. For the process of regeneration of dental pulp, it is vital to revive the vascular supply as well initiate the process of neurogenesis. A study conducted by Nakashima and associates where they primarily derived the stem cells from a canine tooth. This was followed by experimentation for the purpose of judging the neurogenic potential in the limb of a mouse. When a similar clinical experiment was doing by imparting the cells in an amputated pulp section which displayed a complete regeneration of the pulp with the perfect development of nerves as well as blood vessels in a period of just 2 weeks.[12]

CONCLUSION

An incredible alternative has been laid down for the regeneration of the tissues in the oral cavity which would undoubtedly supersede the traditional ongoing techniques. Continuing education and ongoing research on stem cells would play a remarkable role to procure newer therapeutic approaches which would potentially revolutionize the regeneration and healing phase of the oral tissues. Proper disposal of the resources would help to enhance the understanding of the stem cells better which would help overcome the shortcoming of the current scenario.

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