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Review Article

A review on stem cells in dentistry

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ABSTRACT

Cells with the unique capacity of self-renewal and potency are called as stem cells. Stem cells are undifferentiated and pluripotent cells that can differentiate into specialized cells with a more specific function. Defects of Oral and maxillofacial region could be most possibly cured by therapy of stem cells. Through a search in PubMed, Google, Scopus and Medline, many original research papers were found with the keywords such as stem cells, pluripotency, oral and maxillofacial region, stem cell therapy, regeneration. So many review titles were identified, twenty-two articles were retrieved that were finally included as being relevant and of sufficient quality.
This article aims at discussing the use of stem cells for the therapies and specified treatments in the oral and maxillofacial area.

1. Introduction

Stem cells within the body have a novel ability to renew themselves and provides rise to the additional specialised cell varieties that do the work of the body. Stem cells stay generalized till an indication from the body tells them to transform specific cells of the body sort of a heart, nerve, or cells of skin. For years, researchers are learning the distinctive characteristics of stem cells. The primary stem cells studied by researchers were obtained from adult tissues & additionally, scientific studies have enabled analysis on stem cells that are far away from one amongst the earliest human cellular formations, the blastula. [1]

Stem cells research is advancing our data regarding however an organism develops from one cell and the way healthy cells replace broken cells in adult organisms. This promising space of science is additionally leading scientists to analyse the likelihood of therapies which are cell-based to treat diseases that are usually noted as regenerative or reparative medicine. [2]

The stem cell within an embryo can produce to each cell, an organ and tissues within the foetus's body. Not like a normal cell, which might solely replicate to make additional of its own quite cellsnature of stem cell is pluripotent. Once it divides can build anyone of the 220 completely different cells within the material body. [3]

Stem cell biology has attracted tremendous interest recently. Various types of stem cells have been identified by isolating in vivo and in vitro. By broad categorised, they are of two major classes: Foetal (embryonic) stem cells and adult stem cells. [4] Researchers has been working on stem cells to help for both oral and systemic health problems.

2. Stem Cells in Dentistry

Tooth loss due to bone loss could become a thing clarified due to adult stem cell research. Loss of teeth can be a result

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of loss of bone in mouth. However, according to researchers, the postnatal and adult stem cells are showing good results in restoring bones and teeth. According to regenerative dental medicine field, the stem cells are leading to great discoveries.[5]

Regenerative dentistry uses a scientific way, involving developmental and molecular/cellular biology, molecular genetics, and chemical engineering. Recent advances in the fields of dental tissue engineering and stem cell biology, suggest that tooth regeneration will be possible in the near future. According to the published reports, the pulpal tissue progenitor cells present in the deciduous and adult teeth can be used to create dentin and alveolar bone while those present in immature tooth buds can be used to produce tiny, anatomically perfect, whole tooth crowns consisting of enamel, dentin and pulp tissue.[6]

3. Stem Cells of Oral and Maxillofacial Region

There are various types of somatic stem cells present in oro-maxillofacial region or "stem cell niches". These are the stem cells of the apical papilla (SCAP), inflammatory periapical progenitor cells (iPAPCs), dental follicle stem cells (DFSCs), dental pulp stem cells (DPSCs), periodontal ligament stem cells (PDLSCs), bone marrow stem cells (BMSCs), tooth germ progenitor cells (TGPCs), salivary gland stem cells (SGSCs), stem cells from human exfoliated deciduous teeth (SHED), oral epithelial stem cells (OESCs), gingival-derived mesenchymal stem cells (GMSCs), and periosteal derived stem cells (PSCs; Mostly the adult stem cells found in oral and maxillofacial region are mesenchymal stem cells (MSCs).[7,8]

3.1. Pre- clinical studies on complicated oral tissue/ organ regeneration

Regeneration technologies for complicated oral tissues/organs, like the teeth, salivary glands, mandibular condyle and tongue, haven't nevertheless reached the test stage as a result of their biological process and structural quality. However, recent advances based mostly on animal analysis have known possible methods to regenerate these tissues/organs.

3.1.1. Salivary gland regeneration

Salivary glands regeneration by transplantation of stem cells is important study topic for maxillofacial specialty. Due to radiation therapy, there is impairment of salivary gland which may result in xerostomia. The regenerative approaches applied to restore the function of affected salivary glands. Primary approach is development of an artificial salivary gland by tissue engineering technologies.[9–11] Secondary approach is use of stem cells to the affected tissue of salivary gland. In a mouse model, fat obtained Mesenchymal Stem Cells transplanted in irradiated submandibular glands reconditioned function of salivary glands.[12] BMSCs transplanted into the mouse tail vein repaired the salivary glands function.[13]

3.1.2. Regeneration of mandibular condyle

Condylar osteochondral defect arising from trauma or inflammatory disease will results in long pain and disturbed mastication for patients. Strategy of tissue regeneration on these defects will show promise to have an effect on the quality of life (QOL) of these patients. In a model of a goat, the cartilaginous tissue engineering with a gel contained cartilage-derived progenitor cells & distraction osteogenesis was successfully used for condylar osteochondral defects reconstruction.[14]

A mandibular condyle [human shaped] was with success built from chondrogenically and osteogenically produced rat BMSCs encapsulated in a biocompatible compound.[15,16] BMSCs that were produced to distinguished into chondrogenic & osteogenic cells made condylar regeneration of mandible of rabbit that was intensified by ultrasound.[17]

The findings might give an idea for final stem-cell-based tissue engineering of degenerated body part condyles in type of diseases like rheumatic inflammatory disease.

3.1.3. Regeneration of tongue

The surgical resection of tongue tissue will deeply have an effect on the QOL as a result of the tongue has a vital role in speech, deglutition and protection of airway. Hence, tongue reconstruction defects have been a continued challenge. In a rat model tongue reconstruction was reported wherever myoblast or progenitor cells contained in a collagen gel were deep-rooted into the re-sectioned tongue to give productive regeneration of muscle within the tongue.[18,19] The tongue includes skeletal muscle fibres, membrane with style buds, and nervous tissue; thus, functional regeneration is troublesome.

Recent advances in stem cell dentistry & tissue engineering might modify the reconstruction of the broken tongue with normal functions.

4. Future of Stem Cells Research

Expectation of speedy development in adult stem cells & slower, less intense work with embryonic stem cells. The technology of Embryonic stem cells is along with therapeutic cloning. In few cases, these stem cells are truly included into the new repairs as differentiated cells & in different cases they're going to be temporary assistants in native process of repair.[20]

Recent advances in to the adult stem cells biology has given a good deal of impetus to translate these findings into clinical application. The fact that we've got group of stem cells that reform bone and bone marrow, dentin, cementum and maybe periodontic ligament.[21]

We shall conjointly see few recent pharmaceutical merchandises within the pipeline, that promise to try and do a number of an equivalent tricks without extracting a stem cell from the body. These medicines might as an example of bone marrow cells activation and motivate them to migrate to body elements wherever requirement of repairs. Despite this, we are able to expect embryonic stem cell analysis to go on in some countries, with the hope of scientific breakthroughs of assorted types.[20]

The close to way forward for dentistry, as so much several different branches of medicine, can conspicuously feature stem cells & tissue engineering. "Virtually all structures of craniofacial region are mesenchymal cells derivatives. Cells which has characteristics of adultstem cells has been separated from the dental pulp, the deciduoustooth, & the periodontium.

There are few craniofacial structures suchas the condyle of mandible, bone of calvarium, andsubcutaneous adipose tissue which has been engineered frommesenchymal stem cells, growth factor, with or without the help of gene therapy. Craniofacialtissue engineering in the nearfuture, represents an opportunity that dentistry should not miss.[22]

Using patient's own cells, it is possible to envision complete restoration of hard tissues in the oral cavity, thereby reducing chances of histocompatibility.[21]

To add on, the advances to genetically modification techniques of the gene activity of stem cells in their ex-vivo expansion offer betterment of patient's own stem cells even. As an example, the regulation activity of genes of aging process possibly be modified hence "rejuvenating" stem cells and lending them the new take on life.[21]

5. Source of Funding

None.

6. Conflict of Interest

None.

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