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Received: 28.02.2022 Revised: 15.03.2022 Accepted: 01.04.2022

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Review Article

Review on Tissue engineering in oral and maxillofacial Surgery

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Tissue engineering incorporates cellular and molecular biology into building materials and engineering to replace damaged or diseased organs and tissues. Dental damage due to periodontal disease, tooth decay, trauma or various genetic disorders can continue to affect many adults at some point in their lives. Recent advances in dentistry include the production and use of platelet-rich plasma, the measurement of platelet congestion, and the growth factors found in platelets. The real challenge of tissue engineering in clinical care is to reduce the risk of surgery using better biological signals from patient cells or biosynthetic components that may require replacement of lost organs or individual tissues. Repairs can be completed without taking over. Today, the field of tissue engineering is growing rapidly considering the many areas of basic research used in tissue engineering, such as growth factors, release-controlled vehicles, and biomaterials, as well as cells and scaffolding.

Keywords: Tissue Engineering, Mesenchymal stem cells, Maxillofacial restoration, Bone morphogenic proteins.

1. Introduction

The term "tissue engineering" was used extensively in literature until the mid-1980's when tissue and organ surgery was performed or the use of artificial devices or biomaterials. The term "engineering tissue" as it is currently used was coined in 1987 in medicine. Dr. Boston Children's Hospital. Joseph Venkanti and Dr. MIT. A keynote address from Robert Langer explains their new "Science" theme. Technology, and can be cited as a precursor to this new biomedical study. In order to reproduce new tissue somewhere, 3 basic tools are needed: cells, scaffolding and signaling molecules. Tissue regeneration is a very complex and systematic process, but the same process involves three well-known stages of inflammation, proliferation, and remodeling.

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In this process biological symptoms experience an increase in the number of cells that heal or close the wound. Also, the formation of newly formed tissue forms morphogenic signals that cause direct tissue isolation [1].

Marelli et al. It tells the story of filling the osteolytic cavity with PRF and complete bone development was recorded. Tattoo et al. The osteoindictive potential of PRF has been suggested to be related to its neoangiogenic potential and GF concentration, which is related to the content of fibrin and platelet cytokines, ideal for totipotent cell migration and pre-osteoblastic cell function in the surgical site, which is basic aspects of bone regeneration. Mesenchymal stem cells (MSCs) represent a range of regenerative drugs today: MSCs are undoubtedly the future, with the most advanced technology that supports the use of mesenchymal stem cells in an elderly patient to overcome behavioral problems and their use. . Reproductive medicine also shows unexpected trends in the last few years. Recent research has focused on tissue regeneration using

MSCs, taken from sites that are easily accessible and rich in stem cells: The oral cavity has become an important source of MSCs, making surgery accessible to surgeons. In addition to having it, it can prevent the patient's condition from getting worse [2].

2. Mesenchymal stem cells of oral origin

Rehabilitation drugs and tissue engineering are aimed at rehabilitating and repairing damaged cells and tissues in order to establish normal functions. The stimulant drug uses biomaterials, growth factors and stem cells. Tissue regeneration occurs naturally due to the presence of stem cells, which regenerate themselves and are able to divide into one of the specialized cells. However, this reproductive capacity decreases with age and fertility is not sufficient to repair the damage caused by degenerative, inflammatory or tumor-based diseases. The immature and specialized cells have the ability to reproduce and differentiate themselves "by regeneration" and can divide into multiple cell lines.

Stem cells used for regenerative medicine should meet the following criteria:

a) It is mass-acquired and can be divided into multiple cell lines in a repetitive and controlled manner.

b) Patients isolated in a small invasive procedure with minimal illness,

c) Produced according to GMP (Good Production Process) as well

d) It has been safely transplanted over the past decade, as each of these organ cells also plays a key role in tissue repair, many advances in the understanding of stem cell structures have been made [8].

Cells used for tissue repair and regeneration are divided into three main types:

- Embryonic stem cells (ES) are found in embryos
- Old stem cells are found in adult tissue and
- Fluoripotent Stem (IPS) cells are illegally produced by manipulating the genes of somatic cells.

ES and iPS cells are considered fluoripotent stem cells because they develop from three small layers to all cell types. Both stem cells have technical and behavioral limitations, and these cells are easy to control and form tumors after injection. In contrast, older stem cells are multicellular because they can divide into a limited number of cell types. Stem cells, also known as postpartum stem cells or somatic stem cells, each are located in a tissue area called the "stem cell niche".

2.1. ESCs (embryonic stem cells)

They are usually separate from the inner wall of the pre-transplanted blastocyst. In the early stages of development, these embryonic stem cells multiply and become fluoropotent due to harmful proliferation. Behavioral problems, uncertainty of immune rejection and uncontrolled segregation challenge the use of embryonic stem cells.

2.2. ASCs (stem cells)

They live in completely different or adult tissues. ASCs are taken from the medulla of bones, periosteum, muscles, fat, brain, dentin and skin. Stem cells are found in many tissues, such as epithelium, bone marrow, liver, and fatty tissue. Cells from these nests can be extracted, isolated, and propagated in vivo by in vitro techniques. The separation of the terminal after a significant increase was created by the coherence of the situation in the cultural media.

2.3. Influence Pluripotent stem cells (IPSC's)

Stem cell biology is rapidly changing and the concept of stem cell division or somatic cell division is becoming more widespread. Recent research studies have shown that only 4 genes, Oct3 / 4, Klf4, Sox2 and c-Myc, are embedded in the nuclei of cells to mature skin cells into fluoropotent cells. These cells are called "induced fluoripotent stem cells". Although more essential research is needed to gain a basic understanding of these cells, they are still considered a major treatment option. Cellular therapy is rapidly changing and the future use of this advanced craniofacial regeneration technology is promising for patients [1].

Mesenchymal stem cells (MSCs) are immature and diverse cells, usually found in bone marrow aspirants, but can also be derived from fat tissue and periosteum. The term mesenchymal stem cell is less accurate in these types of adult stem cells and has been tested several times. Currently, older stem cells found in bone marrow are called multipotent mesenchymal stroma cells (MSCs).

3. Mesenchymal stem cells in regenerative medicine

MSCs are isolated from all bone marrow aspirants, including scaffolds and growth factors, and have been reported to have the potential to correct cranial deformities in many animal specimens. These studies have shown that MSCs can reduce the problems of craniofacial surgical procedures that require allogeneic tissue grafting or autologous removal at secondary sites. This approach reduces the morbidity and morbidity of donor backgrounds in allogeneic MSCs. Allows almost any unlimited source of cell content [2].

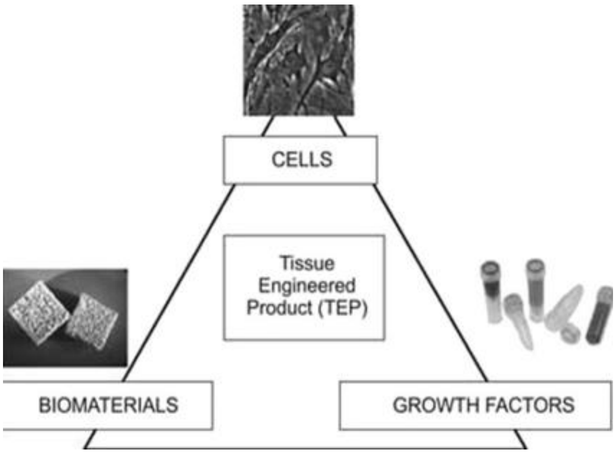

Fig. 1. Classic Tissue Engineering Pyramid

Oral popularity of MSCs living in cavity tissue increases the medical hobby in MSCs as a cellular supply for the regeneration of different connective tissues together with cementum, dentin and periodontal ligament (PDL). several research studies were carried out to evaluate the efficacy of dentally generated MSCs in enhancing periodic regeneration. Seo et al. Human PDLSC has been shown to be able to produce cement / structures similar to PDL when re-implanted in dehydrated mice, and as a result replacement for PDLSC can be considered as a treatment for tissue regeneration caused by periodontal disease. In addition, Kim et al. Alveolar bone production is based on the inclusion of PDLSCs and BMSCs and there is no significant difference in vivo reproductive capacity found in these MSCs. The three most important factors in the field of tissue engineering are stem cells, scaffolding and growth factors. Recently, researchers have been trying to identify an appropriate scaffold that contributes to the growth, proliferation, proliferation, and classification of MSCs. Scaffolding should be bio-compact and biodegradable, with appropriate physical and mechanical properties.

4. Tissue engineering elements

4.1. Biomaterial

4.1.1. Biomaterial tissue reaction

Biomaterials are implanted to enhance tissue function or to decorate tissue restore. In reconstructive surgical procedure they're used to fill defects, to bridge gaps, or to cover wounds. they will function as scaffolds for tissue ingrowth and thereby enhance tissue regeneration or act as stabilizing devices to fix or be part of loose tissue elements.

4.1.2. Scaffolds

The tissue within the cranio maxylofacial area varies in composition, but in its simplest definition, it includes a matrix and a selection of cells.

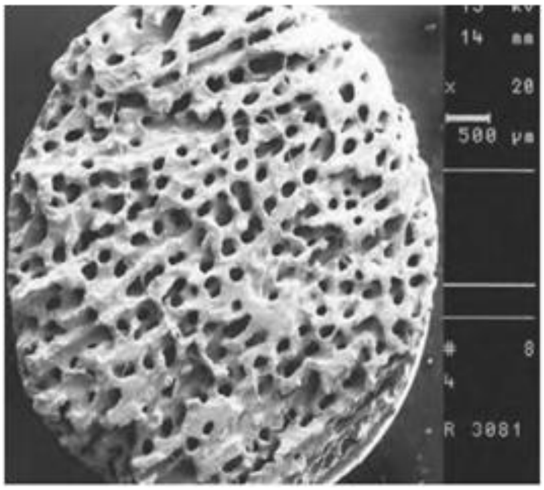

Fig. 2. SEM image of coralline $CaCO_3$ scaffold

3D refers back to the shape or scaffolding for matrix cells, imparting them with a particular surroundings and shape for a given useful cause. The scaffold acts as a template for the vascularization . In popular, the substances which might be used as scaffolds may be divided into natural and inorganic substances. Organic materials may originate from natural precursors such as collagen, chitosan, or silk or can be produced from synthetic polymers such as PLA and polyglycolic acid (PGA).

Inorganic materials commonly consist of metals, alloys, or mineral compositions. Mineral compositions may vary considerably containing mixtures of calcium, sodium, potassium, silicates, magnesium, aluminum, zirconia, carbonates, or phosphates.

4.1.3. Biofunctionalization

The fact that the initial interactions of biomaterials with their host tissues are based on the adsorption of biomolecules from the in vivo milieu on the material surface has promoted the idea of enhancing the integration of these materials by modifying the surface conditions either by enhancing adsorption of these molecules in vivo or by activating biomaterial surfaces with biologically active molecules (BAM's). The strategies vary from altering the physical characteristics through increased surface roughness to physicochemical and/or chemical modification.

4.2. Cells

The strategy of cell-based approaches is to obtain a small number of cells or a small tissue portion through a minimally invasive procedure and to expand these cells ex vivo to a volume that can be expected to form the desired amount and type of tissue. Cell-based approaches are the most complex approaches of all endeavors in tissue engineering because, other than with the application of growth factors, both the host tissue and the biological quality of the seeded scaffolds that are implanted are variable biological success factors. The functionality of these biohybrid constructs depends very much on the survival and the performance of the implanted cells. Thus, besides the local conditions at the recipient site, both the initial cell source and the in vitro handling during cultivation of the constructs are important for successful applications.

4.3. Growth factors

Growth factors are proteins produced by cells that act as signaling molecules on an appropriate cell to carry out a desired function. These proteins activate the cellular communications network and influence functions, such as cell proliferation, matrix deposition, and differentiation of tissues . Growth factors have been shown to play a key role in bone and cartilage formation, fracture healing, and the repair of other musculoskeletal tissues.

Growth factors used in maxillofacial reconstruction

There are at least six growth factors involved in bone regeneration that have been used in maxillofacial reconstruction in a large number of animal models.

- Platelet-derived growth factor (PDGF)
- Primary fibroblast growth factor (PFGF)
- Insulin-like growth factor (IGF)
- Transforming growth factor beta (TGFb)
- Vascular endothelial growth factor (VEGF)
- Bone morphogenetic proteins (BMPs)

5. Conclusion

This approach is already being researched in many international countries: from stem cell filaments in the future to whole organ regeneration and to complex biological systems with different tissues, perhaps with the nano-engineering of living tissue using innovative scaffolding. Collaboration between research firms and multiple centers is the best way to combine the many skills needed to achieve such ambitious results. The authors are working closely with leading international universities to develop protocols aimed at regulating and managing tissue regeneration. This goal will lead to a new generation of stem cell therapy that opens the door to new highly effective regenerative drugs. In just 15 years, starting in 2000, researchers have changed the face of tissue engineering and improved the quality of life of more than 2 billion regenerative surgery patients. The challenge is to continuously improve patients' lives. Make surgery more predictable and easily replace damaged or deformed MSC tissue from dental and oral sources.

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