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Application tissue engineering in the treatment of Temporomandibular disorders

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Abstract

Aim: The aim of this study was to examine the articles of the new use of engineered tissues in the treatment problems of joint temporomandibular jaw. **Materials and methods:** In order to carry out this study, a review of all articles source, books, Medline (PubMed) and Google scholar with a focus on the issue of the use of engineered tissues in the temporomandibular disorders in the period of time 1990 to 2018 done. **Results:** Using the approach of engineered tissue for the different treatment of defects of temporomandibular joint disorders can be helpful is that to them out of there. Ability to build cartilage similar to cartilage naturally by way of a new provision has been. Also, to help gene therapy, cell therapy, reconstruction defect of osteocondral, Ramus even part of the condyle of the left with the ability to comply with part of the left and doing function properly with the remaining part of the use of cells from stem mesenchymal (MSCs). There are factors of growth and cytokine are and provide a scaffold made of polymeric bio- compatible and industries can be differentiated cells from stem mesenchymal to cells of chondrocytes and osteoblasts to cause it. Although they are tried on this is that more regeneration of muscle - Skeletal with the use of the technology and rehabilitation of cells to patients without using scaffolds. **Conclusion:** As a result of this study, the review showed that gives the engineered tissue can be replaced by the old treatment of Temporomandibular joint (TMJ) and reconstructed it be, that benefits such as reducing damage to places of and reduce the risk of rejection of links.

Keywords: Tissue engineering, Stem cell, Temporomandibular disorder.

INTRODUCTION

Temporomandibular joint (TMJ), it is a joint with bilateral articular surfaces consisting of the condylar mandible and glonoid fossa of the temporal bone. It is strengthened, it is surrounded. Intermediate between condyle mandible and temporal bone fossa, articular disc fibrocartilageIt is connected to the bones and capsules by the parasite and the joint space is incomplete in two parts, the upper or lower cavity and the cavity or cavities temporo disc - condyle, divides [1].

It's good to know that the 4 key organs make up the mandibular joint. The first component, like any other joint in the body, is the cartilaginous component, which plays a protective and cushioning role in the location of the bones [2]. One of the unique features TMJ that is, the cartilage that covers the surface of the joint, like the rest of the joints, is not made of hyaline, but of fibrous tissue. Joint cartilage is divided into fibrous and fibrous - cartilaginous regions, which include proliferative and hypertrophic subgroups [3].

The fibrous region includes: fibroblasts and extracellular matrix containing type 1 and 2 collagen and chondroitin sulfate.versican - like It is based on proteoglycans. Area cartilage cells - fibrous, fibroblasts and chondrocytes are [4].

The second component is muscle. These include master, large temporalis temporalis, internal and external petrygoids, and hanging muscles.

The last two components of the internal and external ligaments are the capsules described earlier [2]. Over 50-40% of the world's population suffers from various joint pathologies, including jaw joint involvement [5,6], which requires medical intervention by various specialists in various fields of medicine. And this shows an increasing psychological and social defect [7]. Symptoms temporomandibular disorder (TMD) The peak age of 20-40 years is often characterized by a lower prevalence in younger and older people [8] and a higher gender orientation in women with painful and depressive situations [9].

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Temporomandibular joint (TMJ)

Disorders Temporomandibular - the jaw can cause pain and dysfunction (defects in speaking, chewing and facial expression) there [10]. Triad jaw joint disorders, including muscle aches, joint sounds and limit deviation when opening the mouth [11]. The primary cause of jaw joint disorders, diseases can be traumatic, congenital and degenerative inflammation which includes osteoarthritis and arthrosis. The most common type of jaw joint disorder is dislocation of the joint disc, which can be a prelude to degenerative joint changes and the onset of osteoarthritis [12]. Ordinary osteoarthritis can cause changes in shape, size, and contents TMJ these include flatulence of the temporal fossa, decreased articular protrusion of the immune system, decreased condyle volume, and disc thickening, as well as joint cartilage abrasion and subcondylar bone remodeling, which will lead to deformity and dysfunction. Jaw joint degeneration can also cause disc perforation, complete weakening or lack of cartilage - fibrosis of the jaw joint, supportive bone sclerosis, and osteophyte formation around the ear [13]. Anyway, when TMD involves young people in adulthood, can cause facial asymmetry [14].

Treatment TMD:

Treatment TMD depending on the etiology and severity of the lesion, it can be divided into non-invasive, minimally invasive, and invasive types. And all of them emphasize the relief of symptoms and the repair and replacement of pathological structures.

Non-invasive treatments include medications, orthodontics, physiotherapy and acupuncture. Medications used by painkillers include: NSAIDs, Anti-anxiety, muscle relaxants and opioids. Orthodontic treatments and occlusal splints are widely used for treatment. But their effectiveness will remain in question. Various techniques such as exercise your jaw muscles, stabilize the nervous- muscular, electrotherapy, TENS, Low-intensity ultrasound and laser therapy Low-Level.

Minimally invasive treatments include treatments that require intra-articular injectionplatelet- rich-plasma (PRP), Hyaluronic acid (HA) Arthroscopy, or arthroscopy, is effective in relieving pain in the early stages of the disease but fails in the chronic treatment of pain [15,16]. And invasive treatments include replacing the joint with autogenous or alloplastic material and removing the disc and replacing it [17].

What will be discussed in this review study, the use of tissue engineering and tissue engineering using stem cells as part of the treatment of temporomandibular joint problems - jaw is. Hopefully, this emerging branch of science can alleviate patients' pain. So we need to talk a little bit about tissue engineering, its components, stem cells and the approaches used in it.

Tissue engineering:

Traditionally, the main elements of tissue engineering are based on reconstruction strategies and include scaffolding, cells and biological stimulation. 2 methods are used in cartilage and bone engineering. Tissue Engineering in- suito It uses a scaffold matrix without cells to absorb and stabilize cells on it and perform the regeneration process. And another way ex-vivo Where the cells are placed on the scaffold from the beginning [18]. On the other hand, scaffolds are buried with growth factors to induce faster extracellular matrix synthesis. Intra-articular injection of cells or topical delivery of biologically active molecules can also be used as a strategy. It should be noted that scaffolds used in tissue engineering must be able to differentiate precursor cells from chondrocytes and extracellular cartilage material.

Another strategy is to stimulate mesenchymal stem cells residing in the synovial layer [19]. Mesenchymal stem cells can secrete growth factors, cytokines, and chemokines that play a biologically impaired role [20-22]. These key growth factors include: bFGF IGF-1, TGF- β, fibrochondrocytes from mandibular condyle are less responsive to IGF-1 than hyaline chondrocytes [23]. TGF-ß1 stimlates cell proliferation, and on the production of ECM in TMJ disc implants, and TGF-ß1 and IGF-1 acting together promote cellular proliferation [24] and secretion of type I collagen and glycos aminoglycans [25].

Mesenchymal stem cell (MSCs):

Potential of Mesenchymal Stem Cells. MSCs have been identified from various tissues, such as skeletal muscle, adipose tissue [26], the placenta, the bone, the deciduous teeth, and the synovium [27]. As the most widely studied sources of MSCs for cartilage regeneration, bone marrow-derived MSCs, synovium derived MSCs, and umbilical cord-derived MSCs are mainly discussed below. Bone Marrow-Derived MSCs. MSCs were first identified in the bone marrow via the formation of colonies, represented as colony-forming unit fibroblasts (CFU-F), and bone marrow-derived MSCs (BMSCs) have multilineage differentiation potentials, including chondrogenic and osteogenic differentiation. Synovium-Derived MSCs osteoblasts, chondrocytes, adipocytes, and neurons.

Umbilical Cord-Derived MSC faster proliferative rate and a larger number of CFU-F. the periodontal ligament-derived MSCs could increase the cell proliferation and matrix biosynthesis of cocultured TMJ-derived fibrochondrocytes through paracrine secretion of trophic factors [28]. Author added TNF –α and interferon(IFN-ϒ) to conditioned a medium of MSCs to mimic the inflammatory environment of OA [29] and these cells with parathyroid hormone- like hormone (PTHLH), and bone morphogenetic protein 2 (BMP2), can eventually contributing to the cartilage regeneration and inhibition of OA progression [30]. Tissue engineering approach to making temporomandibular joint cartilage Using biopolymer materials such as fibrin and chitosan (from crustaceans) that combine the ability to form scaffolds to convert basic mesenchymal cells derived from synovium into cartilage-fibroblastic tissue with extracellular deposition Collagen type 1 and 2 and glycosaminoglycans in the rat model are used to make discs and articular cartilage [31,32]. On the other hand, the use of industrial polymeric materials such as polyglycolic acid (PGA) and polylactic acid (PLA) as a mesh for the deposition of extracellular matrix with the help of type 1 collagen in pig joint disc reconstruction is another type of current process in tissue engineering [33]. Today, the scaffold-free approach has attracted the attention of tissue engineers. This may be due to the potential for mismatch between scaffolding decomposition and matrix decomposition, induction of foreign body response, limited mechanical strength after scaffold decomposition, phenotypic changes during scaffolding use, and protection stress. In the scaffold- free method, new tissues with thermomechanical modalities and with self- organizing and self-assembling processes are reconstructed by imitating existing healthy tissues. But it's interesting to note that they are still incapable of rebuilding condyl [34].

METHOD & MATERIALS

this review study, all articles in the electronic source Medline (Pubmed), Google scholar with a focus on the use of tissue engineering in the treatment of temporomandibular joint disease - jaw in the period between 1990-2018 to be searched and examined.

Inclusion criteria: Review articles that have been mentioned in the period in which clinical trials are focused on tissue engineering and cell therapy applications in the treatment of temporal joint problems - jaw was paid. It should be noted that age and sexual modality were not important in these studies and different cell therapy- based processes were included in the selection of articles [35].

Exclusion criteria: All articles that were in a non-English language in previous years or did not meet our criteria were removed from the study.

RESULTS

The results of this review show that mesenchymal stem cells derived from synovium, bone marrow, umbilical cord etc. can be differentiated into scaffolded beds or scaffold-free approaches, as well as in the presence of growth factors. They have chondrocytes and osteoblasts and can be shaped *in-vitro* and use biocompatible or industrial polymers that can encapsulate the condyle to rebuild the temporomandibular joint. What is worth mentioning, the word is that the use of cell L stem cells and growth factors and nutritional environments, it may be in the process of degenerative and inflammatory diseases such as osteoarthritis, degenerative joint reduce or stop . Without disrupting the process of joint proliferation [36]. The results of the studies also show that the use of scaffolding during the weaving engineering process with problems such as complex and precise preparation technique, attention to the speed of scaffolding decomposition, size and shape of pores in it, mechanical properties and power. Tolerating physical stress has been associated with it, so today we are trying to use new methods of tissue engineering to increase the self-sufficiency power of stem cells in the site of injury and the ability to mimic them from healthy adult cells in the environment and provide Proper nutrition and growth factors, the ground for replacing the scaffold-free approach with tools with Pro features Get the tip faster [37].

CONCLUSION

As a result of this study, the review showed that the engineered tissue can be replaced by the old treatment of joint TMJ and rebuild it, that benefits such as reducing damage to places of and reduce the risk of post- tagging links to it. This doubles the importance of stem cells as an essential component of this technique.

Conflicts of Interest

The authors declare no conflict of interest.

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