The 3rd National Festival & International Congress on Stem Cell & Regenerative Medicine

November 28 – December 01, 2018
I.R. Iran International Conference Center,
Tehran, Iran

The 3rd National Festival & International Congress on Stem Cell & Regenerative Medicine
سومین جشنواره ملی و کنگره بین‌المللی علوم و فناوری‌های سلول‌های بنیادی و پزشکی بازساختی

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دکتر امیرعلی حمیدیه
استاد دانشگاه علوم پزشکی تهران
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Council for Development of Stem Cell Sciences and Technologies

History and Background:

Stem cell research began in the late 1950s, when scientists started looking for treatments to help people with untreatable disorders. Advancement in regenerative medicine, from flaps to tissue engineering have taken place thanks to our knowledge on stem cells. We now know stem cells as the core of tissue engineering.

The ultimate aim of scientists in the field of stem cell research is to be able to build tissues or organs that can replace injured or diseased tissues in the human body. This concept which gives rise to the generation of mature tissues has made adult stem cells the focus of intense research, designed to treat a variety of human diseases.

The history of stem cell research in Iran goes back to the first hematopoietic stem cell transplantation (HSCT) in 1990s. Since 1994, Iranian researchers have published papers in stem cells-related fields in domestic and international journals. By 2004, stem cell studies in Iran were developed to include embryonic stem cell research.

Since early 2005, Iranian researchers have also been engaged in the field of tissue engineering and regenerative medicine. Publishing valuable articles in high ranked international journals in these fields of science, has been a continuous trend among Iranian researchers ever since.

The Council for Stem Cell Sciences and Technologies, affiliated to the Iranian Vice Presidency for Science and Technology was established in February 2009 with the aim of accelerating progress towards stem cell based treatments.

The national document of Stem Cell Sciences and Technologies was also approved as part of the country's national scientific map in September 2013 at the Supreme Council of the Cultural Revolution. Iran's headway towards stem cell sciences and regenerative medicine, despite limited investments, reveals the country's enormous potential to grow in this field.

In terms of published papers in the field of stem cells and regenerative medicine, Islamic Republic is ranked first in the Middle East and among Islamic countries and is second among the East Mediterranean and North African countries.

Stem cell research market in the world has grown exponentially over the last decade. It is hoped that due to this incredible increase in investments in stem cell research, Iran will be one of the world's top 10 countries by 2025 in terms of science and wealth creation in this novel area of research.

a specified time. Chemical polymerization was then initiated by adding oxidant solution containing APS and conductive layer was polymerized at around 5°C for 48 hours. In this way, the core/shell nanofibers were synthesized via in situ chemical oxidative polymerization of aniline and the molecules of the drug were incorporated in polyaniline during polymerization. By adjusting the electrospinning parameters and the polymerization conditions the desirable nanofiber structure was fabricated. The PES/PANI/drug nanofibrous scaffold was characterized using scanning electron microscopy (SEM), attenuated total internal reflectance infrared spectroscopy (ATR-FTIR), electrical conductivity and cell culture study.

Results: Based on SEM images, PES nanofibers prepared here were homogenous and defect-free. As well as this, the conductive core/shell scaffold was coated uniformly. It was shown that plasma treatment had a significant effect on nanofibers coating process by increasing hydrophilicity and functionality of nanofibers surface. ATR-FTIR spectra for PES and PANI/PES/drug nanofibers and FTIR spectra for powder material of PANI confirmed the presence of PANI and drug on the surface of nanofibres. Additionally, the conductive scaffold offered acceptable value of conductivity. It was found that the conductivity and morphology of the final nanofibers were strongly influenced by the dopant properties, the concentration of aniline and dopant, and time of polymerization. In addition, the viability of adipose-derived stem cells cultured on the conductive nanofibrous scaffold was found to be excellent and cells had good adhesion to the scaffold.

Conclusion: Herein, we developed a drug-loaded conductive nanofibrous scaffold with a proper cell compatibility. By the combination of nanofibrous topography, electrical activity, and biochemical functionality new multi-functional material with unique physicochemical properties was obtained. The natural conductivity of these composites offers exciting opportunities for electrical stimulation of cells, especially those are sensitive to electrical signals such as nerve cells. So, our scaffold can be an appropriate tool for regulating stem cells behaviors such as proliferation and differentiation.

Keywords: Conductive nanofibers; Electrospinning; Polyaniline; Nerve tissue engineering; Drug delivery; Stem cells

OS-009. Effect of Amount of Tetraethylorthosilicate (TEOS) and Thermal Treatment Temperature on Mechanical and Biological Properties of Gelatin-Calcium Phosphate Scaffolds

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Background and Aim: Clinical demands for bone regeneration continues to rise due to trauma; cancer; infection; and arthritis. Nowadays, the most important topic is developing of complete bioactive three- dimensional (3D) composite scaffold in bone tissue engineering (BTE) which can regenerate bone damages successfully. Variety of materials have been utilized to create novel alternatives instead of conventional ones which had some disadvantages.

Methods: In the present work, gelatin-calcium phosphate composite scaffolds were produced via solvent casting and freeze-drying methods. Amount of tetraethylorthosilicate (TEOS) and temperature of thermal treatment were two factors in which considered as the variations. Synthesizing reinforcing particles were decorated with SiO_4^{4-} to increase bioactivity and osteoconductivity and then were surface modified by Gelatin solution with the aim of forming a good interface between two phases. Finally, gelatin-glutaraldehyde solution and TEOS sol were used as two different coatings on scaffolds.

Results: Scanning electron microscopy (SEM), three-point bending test, simulated body fluid (SBF), and differential thermal analysis (DTA) coupled with energy dispersive spectroscopy (SEM/EDS), allowed us to detect the structure and behavior of the scaffold. According to SEM analyze, there is an interconnected network of pores in the range size of some microns to 200 micrometers. These scaffolds also have considerable mechanical properties from 2 to 5 MPa. Bioactivity analysis illustrated that the interactions of the materials support the apatite formation in SBF. Decoration and surface modification of glass-ceramic particles were totally effective in increasing bioactivity and final strength respectively. Scaffolds which were coated with TEOS sol had more final strength while, the other ones had more toughness According to DTA results, thermal treatment of glass particles in 1100-degree centigrade cause the crystallization of which, enhance mechanical properties, and decrease the osteoconductivity in SBF.

Conclusion: Although all of the scaffolds have been had good behavior in different tests, the scaffold which was produced with a lower temperature of thermal treatment and lower amount of TEOS in particles, is the best choice for bone regeneration in bone tissue engineering

Keywords: Bone tissue engineering; Polymer ceramic scaffold; Thermal treatment

OS-010. Developing a Cost-Effective and Scalable Production of Human Hepatic Competent Endoderm from Size-Controlled Pluripotent Stem Cell Aggregates

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Background and Aim: Dynamic suspension culture of human pluripotent stem cells (hPSCs) in stirred bioreactors provides a valuable scalable culture platform for integrated differentiation toward different lineages for potential research and therapeutic applications. However, current protocols for scalable and integrated differentiation of hPSCs limited due to the high cost of growth factors and technical challenges.

Methods: hPSCs aggregates primed with 6 and 12 µM of CHIR99021 (CHIR), a Wnt agonist, in combination with different concentrations of high-cost Activin A (10, 25, 50, 100 ng/mL). We sought to determine the appropriate treatment duration for efficient and cost-effective differentiation protocol for foregut definitive endoderm production in a dynamic suspension culture. Afterward, we evaluated the impact of the initial hPSC aggregate sizes (small: 86±18 µm; medium: 142±32 µm; large: 214±34 µm) as critical bioprocess parameter on differentiation efficacy at the beginning of induction

Results: One-day priming of hPSCs as 3D aggregates (hPSpheres) with 6 µM CHIR followed by treatment with a low concentration of Activin (10 ng/mL) for 2 days resulted in efficient differentiation to definitive endoderm that highly expressed the anterior endodermal marker HEX. These endodermal cells differentiated efficiently into mature functional hepatocytes. The medium-sized hPSpheres resulted in higher productivity and differentiation efficiency for scalable hepatocytes production, whereas small aggregates resulted in significant cell-loss after CHIR treatment and large aggregates had less efficacious endodermal differentiation. Differentiated cells exhibited multiple characteristics of primary hepatocytes as evidenced by expressions of liver-specific markers, indocyanine green (ICG) and low-density lipoprotein (LDL) uptake, and glycogen storage

Conclusion: This platform could be employed for the scalable production of hPSC-derived hepatocytes for clinical and drug discovery applications.

Keywords: Hepatocyte; Definitive endoderm; Aggregate; Scale-up differentiation; Size-controlled differentiation

OS-011. Autologous Human Stromal Vascular Fraction Injection in Post-Burn Hypertrophic Scar: A Double-Blinded Placebo-Controlled Clinical Trial

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Certificate

This is to certify that

Faezeh Darvishian Haghighi

Has presented a scientific paper entitled

Effect of amount of tetraethyl orthosilicate (TEOS) and thermal treatment temperature on mechanical and biological properties of gelatin-calcium phosphate scaffolds

In the Oral/ Poster Session of the

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General Secretary of the Festival

Dr. Nasser Aghdami
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