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Proteome analysis of human mesenchymal stem cells undergoing chondrogenesis when exposed to the products of various magnesium-based materials degradation.

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Abstract

Treatment of physeal fractures (15%-30% of all paediatric fractures) remains a challenge as in approximately 10% of the cases, significant growth disturbance may occur. Bioresorbable Magnesium-based implants represent a strategy to minimize damage (*i.e*., load support until bone healing without second surgery). Nevertheless, the absence of harmful effects of magnesium-implants and their degradation products on the growth plate should be confirmed. Here, the proteome of human mesenchymal stem cells undergoing chondrogenesis was evaluated when exposed to the products of various Magnesium-based materials degradation. The results of this study indicate that the materials induced regulation of proteins associated with cell chondrogenesis and cartilage formation, which should be beneficial for cartilage regeneration.

Carcinogenesis. 2019 May 2. pii: bgz083. doi: 10.1093/carcin/bgz083. [Epub ahead of print]

The metastatic phenotype shift towards myofibroblast of adipose-derived mesenchymal stem cells promotes ovarian cancer progression.

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Abstract

Ovarian cancer metastasizes to organs in the abdominal cavity, such as the omentum which is a rich source of adipose-derived mesenchymal stem cells (ADSCs). In present, ADSCs have received more and more attention for their roles in the development of cancer. In this study, we examined α-SMA expression and carcinoma-associated fibroblast (CAF)-like differentiation capabilities in ADSCs from omentum of different patients. The effects of ADSCs on the proliferation and invasion of epithelial ovarian cancer cells (EOCCs) were also assessed in vitro and in vivo. Our results showed that ADSCs from omentum of ovarian cancer patients, no matter whether metastasis or not, expressed higher levels of α-SMA than ADSCs from patients with benign gynecologic disease. Using direct and indirect co-culture system, we found that EOCCs induced ADSCs to express CAF markers, including α-SMA and fibroblast activation protein (FAP), via the TGF-β1 signaling pathway. Moreover, co-cultured ADSCs exhibited functional properties similar to those of CAFs, including the ability to promote EOCCs proliferation, progression and metastasis both in vitro and in vivo. Furthermore, blocking the TGF-β1 pathway can counteract the CAF-like differentiation and tumor promotion effect of ADSCs. Our results

suggest that ADSCs are a source of CAFs and that they participate in the interaction between EOCCs and the omental microenvironment. EOCCs could induce ADSCs in the omentum to differentiate before ovarian cancer metastasis, which participate in the formation of omental metastatic niches and promote the proliferation and invasion of ovarian cancer.

Stem Cells Transl Med. 2019 May 2. doi: 10.1002/sctm.18-0226. [Epub ahead of print]

Mesenchymal Stem Cell-Derived Extracellular Vesicles as Therapeutics and as a Drug Delivery Platform.

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Abstract

Mesenchymal stem cells (MSCs) are one of the most easily accessible stem cells that can be obtained from various human tissues. They have raised considerable interests for their potential applications in tissue repair, anti-cancer therapy, and inflammation suppression. Stem cell-based therapy was first used to treat muscular dystrophies and has been studied intensively for its efficacy in various disease models including myocardial infarction, kidney injuries, liver injuries, and cancers. In this review, we summarized the potential mechanisms underlying MSC-derived EVs therapy as a drug delivery platform. Additionally, based on currently published data, we predicted a potential therapeutic role of cargo proteins shuttled by EVs from MSCs. This data may support the therapeutic strategy of using the MSC-derived EVs to accelerate this strategy from bench to bedside.

Croat Med J. 2019 Apr 30;60(2):78-86.

Raman microspectroscopy: toward a better distinction and profiling of different populations of dental stem cells.

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Abstract

AIM:

To characterize stem cells originating from different dental tissues (apical papilla [SCAP], dental follicle [DFSC], and pulp [DPSC]) and test the capacity of Raman microspectroscopy to distinguish between the three dental stem cell types.

METHODS:

SCAP, DFSC, and DPSC cultures were generated from three immature wisdom teeth originating from three patients. Cell stemness was confirmed by inducing neuro-, osteo-, chondro-, and adipo-differentiaton and by mesenchymal marker expression analysis by flow-cytometry and real-time polymerase chain reaction. Cellular components were then evaluated by Raman microspectroscopy.

RESULTS:

We found differences between SCAP, DFSC, and DPSC Raman spectra. The ratio between proteins and nucleic acids (748/770), a parameter for discriminating more differentiated from less differentiated cells, showed significant differences between the three cell types. All cells also displayed a fingerprint region in the 600-700 cm-1 range, and characteristic lipid peaks at positions 1440 cm-1 and 1650 cm-1.

CONCLUSION:

Although different dental stem cells exhibited similar Raman spectra, the method enabled us to make subtle distinction between them.

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Thermally-controlled extrusion-based bioprinting of collagen.

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Abstract

Thermally-crosslinked hydrogels in bioprinting have gained increasing attention due to their ability to undergo tunable crosslinking by modulating the temperature and time of crosslinking. In this paper, we present a new bioink composed of collagen type-I and Pluronic® F-127 hydrogels, which was bioprinted using a thermally-controlled bioprinting unit. Bioprintability and rheology of the composite bioink was studied in a thorough manner in order to determine the optimal bioprinting time and extrusion profile of the bioink for fabrication of three-dimensional (3D) constructs, respectively. It was observed that collagen fibers aligned themselves along the directions of the printed filaments after bioprinting based on the results on an anisotropy study. Furthermore, rat bone marrow-derived stem cells (rBMSCs) were bioprinted in order to determine the effect of thermally-controlled extrusion process. In vitro viability and proliferation study revealed that rBMSCs were able to maintain their viability after extrusion and attached to collagen fibers, spread and proliferated within the constructs up to seven days of culture.

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Human Platelet Lysate Improves Bone Forming Potential of Human Progenitor Cells Expanded in Microcarrier-Based Dynamic Culture.

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Abstract

Xenogeneic-free media are required for translating advanced therapeutic medicinal products to the clinics. In addition, process efficiency is crucial for ensuring cost efficiency, especially when considering large-scale production of mesenchymal stem cells (MSCs). Human platelet lysate (HPL) has been increasingly adopted as an alternative for fetal bovine serum (FBS) for MSCs. However, its therapeutic and regenerative potential in vivo is largely unexplored. Herein, we compare the effects of FBS and HPL supplementation for a scalable, microcarrier-based dynamic expansion of human periosteum-

derived cells (hPDCs) while assessing their bone forming capacity by subcutaneous implantation in small animal model. We observed that HPL resulted in faster cell proliferation with a total fold increase of 5.2 ± 0.61 in comparison to 2.7 ± 02.22-fold in FBS. Cell viability and trilineage differentiation capability were maintained by HPL, although a suppression of adipogenic differentiation potential was observed. Differences in mRNA expression profiles were also observed between the two on several markers. When implanted, we observed a significant difference between the bone forming capacity of cells expanded in FBS and HPL, with HPL supplementation resulting in almost three times more mineralized tissue within calcium phosphate scaffolds. FBS-expanded cells resulted in a fibrous tissue structure, whereas HPL resulted in mineralized tissue formation, which can be classified as newly formed bone, verified by μCT and histological analysis. We also observed the presence of blood vessels in our explants. In conclusion, we suggest that replacing FBS with HPL in bioreactor-based expansion of hPDCs is an optimal solution that increases expansion efficiency along with promoting bone forming capacity of these cells.