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Human Amniotic Membrane as a Matrix for Endothelial Differentiation of VEGF-Treated Dental Stem Cells (Article)

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Abstract

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Introduction: Endothelial cells cover the surface of the capillary wall and literature review has cemented its angiogenic roles in wound healing and tissue regeneration. However, the angiogenic in vitro models available are inadequate to understand the endothelial differentiation process. Methods: A construct was made using human amniotic membrane (HAM) as a matrix to assist the dental stem cells to differentiate into endothelial-like cells. This study aimed to assess the biological interaction between stem cells from human exfoliated deciduous teeth (SHED) and the stromal side (SS) of the glycerol-preserved HAM in angiogenic-induced environment media using VEGF. The changes were evaluated through cell morphology, migration, as well as gene expression level. Results: There were morphological changes observed in SHED in angiogenic-induced media. SHED appeared to be differentiated from fibroblast-like cells to a new structure, mimicking endothelial-like structure through microscopy analysis. Besides, the cross-section of the construct revealed that the cells seeded on the matrix were able to maintain its monolayer structure at day 1, 7 and 14 but infiltrated into the HAM at day 21, suggesting cell migration. The cells were also able to maintain its stemness (Nestin, Nanog and CD29) and at the same time express the angiogenic markers (IL-8, VEGF and MMP-2). Conclusion: HAM promotes SHED proliferation, migration and has the potential as a differentiating matrix for endothelial-like cells. © 2019, Biomedical Engineering Society.

Author keywords

Angiogenic | Endothelial differentiation | Extracellular matrix | Regenerative medicine | Stem cells from human exfoliated deciduous teeth | Vascular endothelial growth factor

Indexed keywords

EMTREE drug terms: beta1 integrin | gelatinase A | glycerol | interleukin 8 | nestin | transcription factor NANOG | vasculotropin

EMTREE medical terms:

amnion | Article | cell differentiation | cell infiltration | cell interaction | cell migration | cell structure | controlled study | deciduous tooth | dental stem cell | endothelium cell | fibroblast | gene expression | human | human cell | human tissue | microscopy | priority journal | stem cell | stem cell culture | stem cell niche | tissue preservation

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Chemicals and CAS Registry Numbers:

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This study was approved by Human Research Ethics Committee of USM (USM/JEPeM/14110477), for the usage of HAM from the Tissue Bank Unit, School of Medical Sciences, Universiti Sains Malaysia. No animal studies were carried out by the authors for this article. APC Allophycocyanin B-actin Beta-actin BS Basement side CD Cluster of differentiation COX-2 Cyclooxygenase-2 ECM Extracellular matrix ECs Epithelial cells FITC Fluorescein isothiocyanate H&E Haematoxylin and eosin HAM Human amniotic membrane HMDS Hexamethyldisilazane HUVEC Human umbilical vein endothelial cells IL-8 Interleukin-8 MMP-2 Matrix metalloproteinase-2 NaClO Sodium hypochlorite PBS Phosphate buffer saline PE Phycoerythrin PerCP Peridium-chlorophyll protein complex PVDF Polyvinylidene fluoride RT Room temperature RT-PCR Reverse-transcriptase polymerase chain reaction S SHED only SA SHED cultured on HAM SAV SHED cultured on HAM treated with VEGF SDS Sodium dodecyl sulfate SEM Scanning electron microscope SHED Stem cells from human exfoliated deciduous teeth SS Stromal side SV SHED treated with VEGF T-PBS PBS containing 0.1% Tween-20 VEGF Vascular endothelial growth factor View less

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