The Influence of Conductivity and Mechanical Properties on the Neurogenic Differentiation of Dental Pulp Stem Cells

Liu, Samuel (School: Olathe North High School)

Adult stem cells are significant candidates in regenerative medicine due to their ability to self-renew and differentiate into multiple specialized cells. Dental pulp stem cells (DPSCs) are pluripotent stem cells which can be differentiated along odontogenic, osteogenic, adipogenic, or neurogenic lineages. Here we wish to explore whether substrate young's modulus and conductivity are also important in determining differentiation of DPSCs into neurons. PB films, 25 nm (thin) and 250 nm (thick) films with and without G were spun cast out of toluene onto silicon wafers. The samples were annealed at 150C in ultra-high vacuum. Atomic Force Microscopy (AFM) analysis indicated that the G platelets were encapsulated and well distributed within the thick PB films. Aggregation of the graphene platelets, protruding from the film surfaces, were observed in the thin films. The relative modulus of the cells and substrates were also measured using shear modulated force microscopy (SMFM). The modulus of the cells was then measured after 3 days in culture. After 21 days, Real-Time Polymerase Chain Reaction (RT-PCR) was used to identify mRNA levels of genetic markers of neurogenic differentiation (NES, TUBB3, NEFM) relative to day 0. The SMFM results indicated a positive correlation between substrate and cell modulus. However, this did not correlate with the expression of genetic neurogenic markers after 21 days. This suggests that the mechanical differences of either the substrate or the cells were not a factor in inducing differentiation. The results also indicated no significant differences in neurogenic expression between the substrates with and without graphene, suggesting that the enhanced conductivity of the substrate was not a factor in inducing differentiation.

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