ABSTRACT

The combination of tissue engineering and polymer synthesis aims to further cell growth and proliferation with the goal of repairing damaged tissue. One particular approach is to assess the potential of nitric oxide (NO) releasing polymers on pre-osteoblast cell adhesion and proliferation. Nitric oxide is released endogenously by endothelial cells as a natural inhibitor of platelet activation, promoter of angiogenesis, and an antimicrobial agent. The addition of three biomedical grade polymers: carboxil, tefloflex SG80A, and poly-L-lysine (PLL) are used to control the flux of an NO donor, S-nitroso-N-acetyl-D,L-penicillamine (SNAP) [1]. The effects of NO on osteoblast cells have been shown to vary depending on concentrations and rate of release [2]. Different combinations of NO concentrations and polymer were fabricated to test the most optimal environment for osteoblast adhesion and proliferation. It has been tested that polymers containing PLL, either as a foundational polymer or topcoat, promoted cell adhesion. However, higher concentrations of SNAP did not support cell adhesion and viability when compared to smaller amounts. Future studies will optimize the rate of release of NO as well as the fabrication of such polymers to contain lower concentrations of SNAP to promote cell proliferation.

RESULTS

Figure 3. Percent increase in mass of polymer films due to absorption of water after 24 hours and incubated at 37°C.

Figure 4. UV-Vis spectra was recorded to determine the % SNAP remaining in the film in either ambient light or UV sterilized conditions.

Figure 5. Daily NO release from SNAP-doped Carbosil and SG80A topcoated with PLL and incubated in cell cultured media at 37°C.

Figure 6. alamarBlue™ representing cell viability between two concentrations of SNAP solution compared to cells just seeded in the tissue culture plastic as well as cells exposed to the PBS solution by itself.

Figure 7. Live/Dead Assay depicting the viability of cells exposed to PLL polymer with varying concentrations of SNAP.

Figure 8. PicoGreen® representing the DNA concentration of cells seeded on PLL and Carbosil with a topcoat of PLL and doped with varying levels of SNAP.

CONCLUSIONS

• UV Sterilization for 1 hour does not affect the release of NO.
• Carboxil has a slower NO releasing rate due to its lower water absorption; SG80A has a faster NO releasing rate due to its higher water absorption.
• PLL as a polymer or topcoat supported pre-osteoblast adhesion and viability as opposed to just the Carbosil or SG80A surface by itself.
• PLL and Carbosil topcoated with PLL provided the most optimal release of NO, supporting cell viability and high DNA concentrations.
• Future studies will consider fabricating the polymer films with a thicker topcoat to lower the NO release rate and better control leaching of the SNAP molecule, decreasing the concentration of SNAP, as well as deciphering if there are any other NO donors that are more optimal for osteogenesis.

REFERENCES


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