Effects of Cyclic Mechanical Stretch on MDA-MB-231 Breast Cancer Cell Behavior

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Introduction: While it is known that physical activity has been linked to a decrease in breast cancer prevalence, the mechanisms through which physical activity regulates breast cancer cell behavior remains poorly understood[1,2]. Studies have shown that cancer cells have differences in mechanical properties such as stiffness, elasticity, and adherence when compared to normal cells[3]. In addition, more recent studies have produced better in-vitro systems for modeling local organ microenvironments under flow conditions[4] which had previously limited investigations of cancer cell metastasis. This study investigates the effects of cyclic mechanical stretch on breast cancer cell adhesion, proliferation, and chemotherapeutic resistance.

Materials and Methods: MDA-MB-231 breast cancer cells were pretreated an hour before being stretched at 7.5% strain at 1 Hz for 1 hour. For the cell survival assay, cells were fixed, permeated, and stained with DAPI before being imaged utilizing confocal microscopy. Cell nuclei were counted using FIJI's analyze particle function. For the cell adhesion assay, cells were trypsinized, labeled, and allowed to recover for 1 hour. Cells were sheared under physiological conditions (0.5 dynes/cm^2) for 1 hour and the number of adhered cells was read using a plate reader. Cells were then exposed to incremental shear stresses for 1-minute intervals and adhered cells were read in between runs with the plate reader.

Results and Discussion: Doxorubicin and Verteporfin treatments significantly decreased cell survival, while cyclic mechanical stretch showed no significant effect on breast cancer cell survival. At shear stresses below or at 2 dynes/cm^2 cyclic mechanical stretch significantly affected the adhesion of breast cancer cells treated with DMSO.

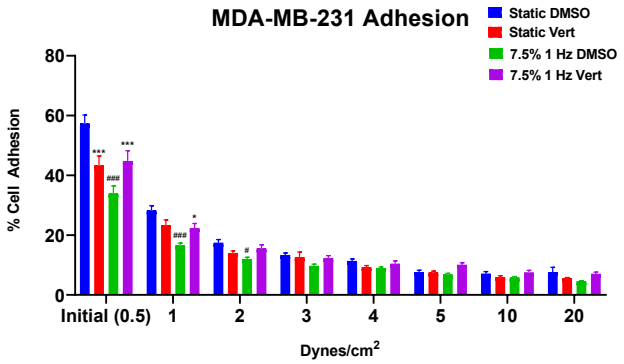

Figure 1. Cells were stretched for 24 hours at 7.5% strain at 1 Hz. Cells were pretreated for 1 hour before stretching. Cells were detached from stretch plates and allowed to recover for an hour before administration of adhesion assay.

Conclusions: Inflammation of endothelial cells used in the adherence assay was controlled for with TNF-α (10ng/mL). However, initial adherence was higher than previous reiterations leading us to believe that there may have been some oil residue on the HT-CAP that caused more inflammation on endothelial cells. The effects of cyclic mechanical stretch should be investigated in other breast cancer cells such as MCF-7.

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