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Human endothelial cell responses to cardiovascular inspired pulsatile shear stress MATTHEW WATSON, LAUREN BAUGH , LAUREN BLACK III , ERICA KEMMERLING, Tufts University — It is well established that hemodynamic shear stress regulates blood vessel structure and the development of vascular pathology. This process can be studied via in vitro models of endothelial cell responses to pulsatile shear stress. In this study, a macro-scale cone and plate viscometer was designed to mimic various shear stress waveforms found in the body and apply these stresses to human endothelial cells. The device was actuated by a PID-controlled DC gear-motor. Cells were exposed to 24 hours of pulsatile shear and then imaged and stained to track their morphology and secretions. These measurements were compared with control groups of cells exposed to constant shear and no shear. The results showed that flow pulsatility influenced levels of secreted proteins such as VE-cadherin and neuroregulin IHC. Cell morphology was also influenced by flow pulsatility; in general cells exposed to pulsatile shear stress developed a higher aspect ratio than cells exposed to no flow but a lower aspect ratio than cells exposed to steady flow.

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