3D microtissues to model infarction injury and methods preparing and using the same

Published date: May 22, 2019

Technology description

Market Overview
These cardiac microtissues mimic the presentation of infarct injuries in individuals with cardiovascular disease, such as heart attack or stroke, allowing for a model to study pathogenesis and drug development for injuries caused by cardiovascular disease. Cardiovascular disease is the leading global cause of death, accounting for more than 17.6 million deaths in 2016. While incidences of cardiovascular disease are on the rise globally, human organoid systems have largely focused on modeling genetic disease, rather than tissue-level pathology, such as heart attack or stroke. This speaks to a need for a human infarction model for drug development and disease progression research. Where previous models relied on 2D multicellular systems, or drug-induced oxygen depletion, this method utilizes upstream stimuli to create and control the formation of the tissue injury. Clemson University researchers have developed a method for producing organoids that accurately mimic cardiovascular disease injury at the 3D tissue level.
This technology is an infarct model generated by oxygen deprivation of tissue microspheres. The 3D microtissues/organoids are grown in a controlled low oxygen environment, with non-viable levels of oxygen creating the region of damaged cells representing the "infarct" and creating a gradient of oxygen in the outer zones of the microsphere. This utilizes transport limitations of tissue engineering, as these spheres are not vascularized, and oxygen diffusion to
the center of the sphere is limited by its size. This serves to recreate the 3D structure of infarcted tissue, which damages the cells in a similar physiological manner to an actual infarct. This method can be used to model pathogenesis of infarction injury by tracking changes in microtissue genetics, structure, and function over time, screen patient-specific tissue-level response to infarction injury, such as Type I diabetes, drug screening for infarction injury response, as well as re-oxygenation/reperfusion injury.

Application area

Medical, tissues engineeringIn vitro data

Advantages

• Mimics biological conditions to induce infarct injury, creating a near identical injury to that seen in infarct tissue
• This approach focuses on mimicking the oxygen gradient in infarcted tissues, ensuring more accurate models of injured human organs
• Patients' generated tissues can be screened for drug reaction, reducing the time needed to achieve a proper drug prescription.

Institution

Clemson University

Inventors

Ying Mei
Assistant Professor
Bioengineering