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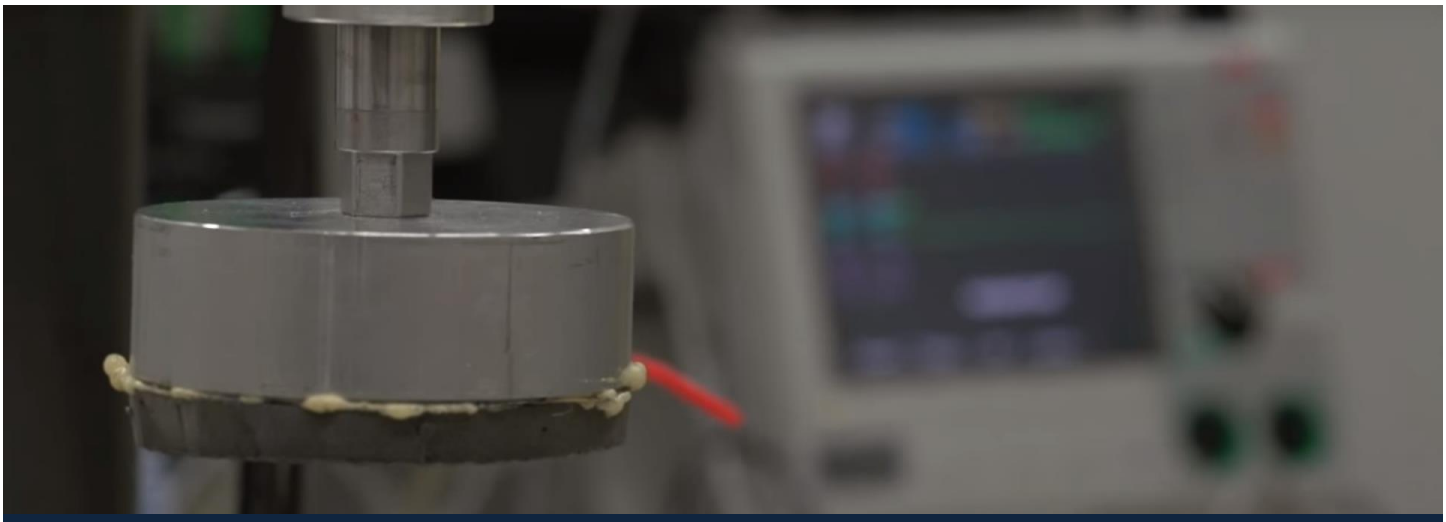

Smart CPR that Adapts to the Patient ID: 2853

Featured Innovators: James Menegazzi, PhD, David Salcido PhD MPH, and Matt Sundermann, PhD

Current CPR techniques don't take into account the individual physiology of the patient – such as chest size, blood perfusion signals, and cardiac arrest cause – despite the importance of these factors for patient outcomes. Our automated mechanical chest compression device for cardiopulmonary resuscitation ("Smart" CPR) adjusts thrust depth and rate to the current needs of the patient. Although there are other automated CPR systems on the market, all of them give fixed compressions across patients and time, so ours is the only system that can provide shallower compressions for a child or more rapid compressions for a patient in decline.

Technology Description

Our device compresses the patient's chest through a linear actuator controlled by a SmartMotor™. The position of the actuator is calculated with high precision by an optical encoder and a potentiometer. Our device could be linked to a cardiac monitoring system – which is already ubiquitous across ambulance fleets – that is capable of measuring electrocardiogram and perfusion signals. Then these signals could be used in real time to adjust the parameters of the Smart CPR compression arm. Animal studies have shown that Smart CPR provides greater blood perfusion and leads to more favorable survival rates from cardiac arrest.

Advantages

- Automated
- Personalized
- Adaptive
- Can be linked to current cardiac monitoring systems in ambulances

Applications

- Paramedicine
- Hospitals
- Nursing homes

Stage of Development

working prototype

IP Status

US non-provisional patent application 15/105,510

Notable Mentions

Center for Medical Innovation grants totaling $19,000

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Innovators

James Menegazzi, PhD

Professor
Emergency Medicine
University of Pittsburgh

Education
PhD University of Pittsburgh
MS University of Massachusetts
BA University of Pittsburgh

Dr. Menegazzi's research interests include resusciation from cardiac arrest, ventricular fibrillation, ventilation adjuncts, and emergency medicine.

Publications

- Reynolds JC, Salcido DD, Sundermann ML, Koller AC, Menegazzi JJ. Extracorporeal life support during cardiac arrest resuscitation in a porcine model of ventricular fibrillation. J Extra Corpor Technol. 2013. 45(1) 33-9
- Reynolds JC, Salcido D, Koller AC, Sundermann ML, Frisch A, Suffoletto BP, Menegazzi JJ. Tissue oximetry by near-infrared spectroscopy in a porcine model of out- of-hospital cardiac arrest and resuscitation of-hospital cardiac arrest and resuscitation. Resuscitation. 2013. 84(6). 843-7.
- Reynolds JC, Salcido DD, Menegazzi JJ. Correlation between coronary perfusion pressure and quantitative ECG waveform measures during resuscitation of prolonged ventricular fibrillation. Resuscitation. 2012. 83(12) 1497-502
- Reynolds JC, Salcido DD, Menegazzi JJ. Conceptual models of coronary perfusion pressure and their relationship to defibrillation success in a porcine model of prolonged out-of-hospital cardiac arrest. Resuscitation. 2012. 83(7) 900-6.
- Salcido DD, Kim YM, Sherman LD, Housler G, Teng X, Logue ES, Menegazzi JJ. Quantitative waveform measures of the electrocardiogram as physiologic feedback uring resuscitation with cardiopulmonary bypass. Resuscitation. 2012. 83(4).
- Salcido DD, Menegazzi JJ, Rittenberger JC. Electrophysiology and hemodynamics of open chest resuscitation from cardiac arrest in a swine. Acad Emerg Med. 2009. 16(1) 89-90.

David Salcido, PhD MPH

Postdoctoral Researcher
Emergency Medicine
University of Pittsburgh

Education
PhD University of Pittsburgh
MPH University of Pittsburgh
BS University of Pittsburgh

Dr. Salcido began his resuscitation research work in 2006 as a research technician under the mentorship of Dr. Menegazzi. Since then he has developed interests in cardiac arrest physiology (acute phase), resuscitation device and robotics development, signal analysis, and emergency medicine epidemiology. Currently, Dr, Salcido is a collaborator on Dr. Menegazzi's "Utilization of Quantitative ECG Measures During Cardiopulmonary Resuscitation" project, and a K12 Scholar with the NHLBI-Sponsored Career Development Program in Emergency Medicine Research.

Matt Sundermann, PhD

Clinical Research Scientist
ZOLL Medical Corporation

Education
PhD University of Pittsburgh
BEng Vanderbilt University

Dr. Sundermann completed his PhD in biomedical engineering in fall 2017 and has since begun working at ZOLL Medical Coporation. For his thesis work, Dr. Sundermann was trained in the use and maintenance of eight different artificial heart support devices, managed care of adult and pediatric patients, and tracked device paramters for clinical trials. During most of this time he was also working as an emergency medical technician at Foxwall Emergency Medical Services.

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