Next-Generation Bioengineers Develop New Defibrillator Shirt

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Undergraduate bioengineering Students at the John Hopkins University in Maryland have developed a new lightweight defibrillator ‘shirt’ which will potentially allow patients at high risk of cardiac arrest or serious arrhythmias to wear a user friendly, unobtrusive life saving device.

Currently, there is only one Wearable Cardioverter-Defibrillator (WCD) device available on the market, the ZOLL LifeVest. The device operates via the use of a shoulder ‘harness’ which incorporates dry, non-adhesive electrodes to continuously monitor cardiac activity in order to detect serious arrhythmias and sudden cardiac events. A monitor is attached to the garment which acts as an external cardiac defibrillator. The device is capable of discharging automatically and delivering a life-saving electric shock to the heart when needed. The monitor is currently attached to the patient either via a shoulder harness or around the waist.

The students at John Hopkins researched the use of the device and observed that clinical adherence in wearing the potential lifesaving vest was very poor due to discomfort, visibility, lack of sleep, and safety alarms which ‘beep’ every time when there is poor contact on the skin with the electrodes. There have also been issues related to unnecessary shocks caused by false alarms. As the vest is potentially a life preserving device, it is imperative that usability and patient acceptability are at the forefront of the design process.

The students worked closely with clinicians to develop a new device that addressed all these issues. Designed from a new lightweight, stretchable, breathable material, the wearable ‘shirt’ is easy to hide under normal clothing and is also waterproof. The device is capable of delivering a 200-joule shock, with the electronic gadgetry hidden within the material. The controller has been redeveloped to incorporate wireless technology and is worn on the wrist as a watch. Incorporated in the wrist controller is a ‘Shock Alert’ which warns the user with a 30 second alert of a pending voltage discharge – this gives the user the opportunity to stop a pending shock caused by a false alarm.

The new device recently won First Prize in a competition sponsored by the North American Professional and Entrepreneurs Council beating many post-graduate, doctorate and MBA development groups. It was also awarded Most Innovative Design honour at the Universitys’ Engineering Design Day and awarded Peoples’ Choice Award, voted for by attendees on the day.

The considerations of this type of development are several fold. Firstly, it illustrates the innovative, fresh approach that can be achieved by students who see things from a different, commercially unadulterated angle. Secondly it’s an indication of the design talent that is being nurtured and our future ‘designers in the making’. It is also a clear representation of the fundamental place that end-user acceptability plays in the success of adherence and functionality of medical devices. The students aim to continue to develop and refine their product.

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