Web will work wonders for the faint hearted

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PhD student David Keeling with the web material that will be used in the development of the heart assist device. Credit: Simon & Simon Photography

A new device could put the beat back into weak hearts - and free patients from a lifetime of anti-rejection drugs.

Current implanted heart assist devices function by sucking blood from the ventricles and then expelling it into downstream vessels. Whilst these have been successful in prolonging the lives of heart patients, they come into contact with the blood stream and hence require life-long drug therapy to suppress the immune system and prevent blood clotting. In

addition, many of these devices use high speed turbines to produce the pumping force, and this has been proven to cause damage to cells within the blood increasing the chance of clots forming.

The ingenious device being developed by engineers at the University of Leeds provides a less invasive alternative. The team has developed a specially-woven web made from biocompatible material which will not be rejected by the body.

The webbing wraps around the heart and therefore does not come into contact with the blood stream. Inbuilt sensors recognise when the heart wants to beat and trigger a series of miniature motors which cause the web to contract – increasing the internal pressure and assisting the heart to pump the blood around the body.

The team consists of Drs Peter Walker (who devised the original concept) and Martin Levesley from the University's School of Mechanical Engineering, cardiac consultants Kevin Watterson and Osama Jaber from Leeds General Infirmary and engineering PhD student David Keeling. The research has been funded by Leeds-based medical charity Heart Research UK.

"It's a really simple concept that works in the same way as when you squeeze a plastic bottle, forcing the liquid inside to rise," says PhD student David Keeling who has built a special rig to test the device.

The device is currently at prototype stage with team using a computer simulated model of the human blood flow circuit coupled to David's mechanical rig. The rig replicates the motion of the heart within the simulation under different conditions, and allows the team to test their web device. The group is currently testing their latest prototype, aiming to refine design and assist strategies. Says David: "We've been looking at finding the optimum timing to trigger and also length of the compressive

squeeze."

Once the mechanics have been perfected, the team intends to simulate the effects of different heart diseases to gauge the potential success of the device.

Potential uses for the device are huge. As well as offering support to people suffering from heart and valve problems, the device could also be a bridging aid to patients as they wait for transplants, providing them with a better quality of life. Says David: "Recent research has found that with some heart diseases, supporting the heart for a short period with an assistive device reduces the work-load on the heart and allows it to rest and recover. Our device also allows for a controlled relaxation of the heart muscle after contraction, which means that it's being supported throughout the whole heartbeat process. It's the same as when you pull a muscle in any other part of your body, rest can often be the best therapy."

Source: University of Leeds