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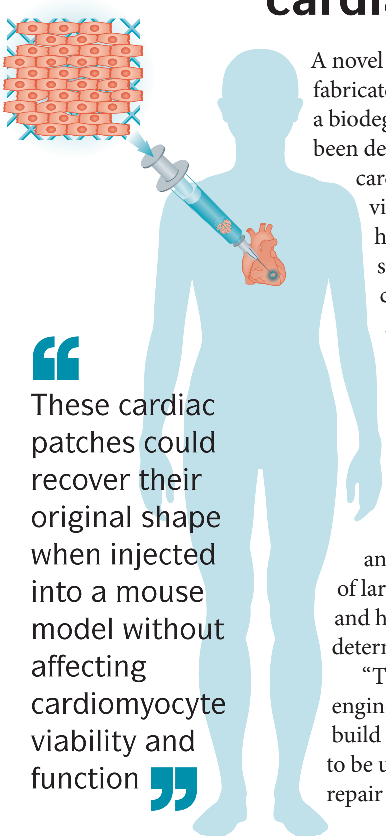
BASIC RESEARCH

Minimally invasive delivery of engineered cardiac patches for heart repair



> These cardiac patches could recover their original shape when injected into a mouse model without affecting cardiomyocyte viability and function

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A novel elastic and microfabricated scaffold created using a biodegradable polymer has been developed to produce cardiac patches for delivery via injection into the heart. These patches significantly improved cardiac function in a rat model of myocardial infarction compared with untreated controls, according to a new study published in *Nature Materials*. Whether these patches can be integrated into and repair the hearts of larger animal models and humans remain to be determined.

"The new field of tissue engineering enables us to build tissues in the laboratory to be used to replace or repair damaged organs in the body", explains Milica Radisic, lead investigator of the study. "However, currently the only way for the tissues to get into the body is through an invasive surgical approach." To overcome this issue, Radisic and colleagues developed a shape-memory scaffold constructed from a biomedical elastomer to engineer cardiac patches that could be folded and injected through a 1 mm orifice. These cardiac patches could recover their original shape when injected into a mouse model without affecting cardiomyocyte viability and function.

A rat model of myocardial infarction was subsequently used to measure the functional effects of implanting a cardiac patch. Implantation of the patch in rats 7 days after myocardial infarction significantly improved several measures of cardiac function assessed using echocardiography and pressure–volume loop analysis compared with the untreated controls. Furthermore, these rats had less pronounced dilatation and greater total wall thickness.

Finally, the investigators set out to test the feasibility of this minimally invasive delivery technique in a larger porcine model using cardiac patches based on human pluripotent stem cell-derived cardiomyocytes. These cardiac patches were successfully implanted in the porcine epicardium, liver, and aorta.

Before these patches can be tested in humans, "we need first to perform long-term studies in large animals such as the pig to understand the biodegradation and integration of these patches," emphasizes Radisic. With advances in minimally invasive surgical techniques, newly designed scaffolds can be of benefit to translational studies in the future.

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ORIGINAL ARTICLE Montgomery, M. *et al.* Flexible shape-memory scaffold for minimally invasive delivery of functional tissues. *Nat. Mat.* http://dx.doi.org/10.1038/nmat4956 (2017)