

Healing a heart break



Dr. John LaDisa is working to create better medical devices for children and adults with cardiovascular problems.

By Nicole Sweeney Etter

Roughly one in 100 children is born with a heart condition, and one of the most common conditions involves a narrowing of the aorta. In an adult, that is easily fixed with a stent that widens the artery. But there's no FDA-approved stent meant specifically for children.

That's a problem that Dr. John LaDisa, a Marquette assistant professor of biomedical engineering, is determined to solve. LaDisa's team is trying to create a stent that could grow with a child.

"It's something we've been working on for a long time, and it turns out that it's more difficult than we thought — than anyone thought," LaDisa says. And because the market for pediatric stents is a fraction of the adult market, very few companies are interested in taking up the challenge. That's why, La Disa says, a new pediatric stent will most likely have to come from a lab like his.

Why is that task so difficult? "The problem is that the aorta of a kid goes from several milliliters to 2.5 centimeters, so you have to find a way to somehow expand it over time," LaDisa explains. "There's a lot of material there that you have to store somewhere. And that's the problem — finding a way to store that extra metal or plastic somewhere in the design of the device."

LaDisa's interest in pediatric cardiology began when he was doing his post-doctoral work at Stanford University. Now he directs Marquette's Laboratory for Translational, Experimental and

Computational Cardiovascular Research. He describes his lab's overall focus as "understanding how changes in fluid flow can affect disease."

Computational modeling is a critical first step to creating a new device. "Before we get to the point of manufacturing something, we need to understand what the stent does to improve blood flow. We need to understand how the rigidity of the stent affects flow and blood vessel motion," LaDisa explains.

Look for LaDisa's work soon at Discovery World at Pier Wisconsin. His cardiovascular modeling is the basis of the Vascular Voyage exhibit in development for the Human Interactive Virtual Education display.

"The aorta is the most compliant artery in the whole body, so if you have a really stiff stent and a really compliant aorta, that creates issues. There are a lot of questions on the front end that still need to be answered."

With few other options, cardiologists sometimes adapt adult-sized stents for pediatric patients.

"Since stents have been very beneficial in adults, it's natural that now they're starting to be used with kids," LaDisa says. "Cardiologists use adult stents meant for other parts of the body and try to find the best match for the artery being treated in a child." That might

work if the child has stopped growing. But if the child outgrows the stent, then narrowing could redevelop.

LaDisa also was recruited for another project by Dr. Bon-Kwon Koo, a world-class clinician in Korea. Koo's focus is stenting the coronary arteries, specifically, cardiovascular disease that involves lesions at the point of coronary bifurcations, where an artery branches off. "It's a really common location for disease to occur, and the success rate is not

great," LaDisa says. "About 20 percent of coronary interventions involve a bifurcation. If you had a better way of treating it, it could really make a difference."

LaDisa's role is to analyze bifurcation patterns and the related blood flow. "If you look at the branching pattern of a tree, no two trees are exactly the same.

But if you look at hundreds of trees and group them, you'd probably start to see some common trends," he says. "We're trying to identify those trends from arteries in about a hundred people and then understand the fluid flow."

Better understanding the impact of a stent on blood flow and the blood vessel environment is likely key to designing a more effective device. And that, LaDisa says, will "hopefully lead to further long-term success in patients with cardiovascular disease. That is what our team is striving for."