A Heart for Long-Term Care

Local doctor, engineer craft design for new model of artificial heart

By Alex Groves, The Capistrano Dispatch

South County resident Vince Abello vividly remembers the more than one-year period that he was living with an artificial heart, awaiting a permanent transplant.

Abello said the artificial heart, from company SynCardia, was a blessing because it allowed him some movement and freedom after a long time spent connected to machinery in the hospital, but the heart also had its downsides.

Abello had to carry around a 17-pound external air pump with him everywhere and had tubing protruding from his chest area. He couldn’t swim and couldn’t take long trips out of the area.

He also lived with the knowledge that the SynCardia heart was only temporary and that another surgery was around the corner.

“You just don’t want to keep going back in that surgery room, because that’s horrifying,” he said.

Abello is one of hundreds of people across the country who have to utilize the SynCardia heart, which is intended only as a temporary solution for patients as they await a possible heart transplant.

San Juan Capistrano resident Peter DeSilva, a family physician, and Rancho Santa Margarita resident Steve Smith, a master pump engineer, are hoping to change that.

Since 2013 they’ve been working on a bionic heart with no external features they hope patients will be able to utilize permanently.

“This will be, eventually, destination therapy,” DeSilva said. “It means you plug it in and play. That’s it.”

How It Works

The heart, dubbed the Freedom Heart, would have four chambers like an actual heart, but would not have parts prone to failure such as valves, seals and gaskets.

Because all components of the system would be inside the body, DeSilva and Smith are hoping that people will be able to jog, bike and even swim.

DeSilva said the heart was made with redundancies, so if any particular component were to fail another component would assume that function.

For example, Smith said, if any one of the motors that power the Freedom Heart’s four turbines were to stop working, the other three would pick up the slack until something could be done to repair the non-functioning motor.

The heart would be Bluetooth-enabled and would be able to send notifications to the cell phones of both a patient and their cardiologist if a part starts to have mechanical issues.

Though the heart will be powered by two batteries, those batteries will likely be powered through induction from inside the body.

DeSilva and Smith are also hoping the Freedom Heart would eliminate the need for anti-rejection medications that heart transplant patients need. The medications lower a patient’s immune response and can make the person more susceptible to certain illnesses.

“It’s all made of biocompatible material,” DeSilva said. “So in other words your body is oblivious to it; it doesn’t even know that it’s there.”

An Idea Emerges

Smith first started to formulate the idea for a bionic heart in 2013 while he was working on a pump to spray radar absorption material onto Northrop Grumman B-2 Stealth Bombers. He wondered whether the certain parts of the pump could be used for an artificial heart.

He brought his idea to DeSilva, who had known for years, and the two started to explore the concept.

“It would have pumped fine,” Smith said of an initial design. “But it would kill blood left and right. It was never really a concept that was validated. It was more of a starting point.”

DeSilva and Smith went through more than 50 design changes. DeSilva said that often after being finished with his medical practice for the day, he would meet with Smith and they would consider ideas for the heart design for hours.

The partners applied for a patent in 2013, and in 2016, it was granted.

Since then, the duo has continued to make modifications as they work with University of Southern California heart surgeon Mark Cunningham. Cunningham has offered insight into how to make the heart easier to transplant during surgery.

Where the Project is Going

DeSilva said the company he and Smith started, California Cardiac Solutions Inc., has received about $1.5 million in investor funding. He stated that this will enable the company to perform bench testing where antifreeze – which is similar to the thickness of blood – will be run through the heart to measure such things as flow and pressure.

DeSilva said the next funding hurdle will be obtaining about $5 million to do animal testing necessary for FDA approval.

He said the final step will be trying to get acquired by a larger company with the resources to begin clinical trials and eventually distribute the heart at some point in the future. He says the company is hoping to be acquired by 2020.

“We’re going to let them to do that,” De Silva said. “They’ll have an uptick in their stock value because of a new product coming in, they use that money from the public to be able to do the clinical studies and then they license that to companies all around the world and then each country will decide what kind of patient they’re going to use it in and how they’re going to use it.”

DeSilva says that he’s been met with resistance on the project from various investors who have told him what he’s trying to accomplish can’t be done.

Though he’s still in the early stages of putting together the heart, DeSilva said he has already made it further than a lot of investors thought he would.

“There are a lot of things that people said couldn’t be done and we’re proving them wrong, one step at a time,” he said.

A Different Trajectory for Heart Patients

These days Vince Abello is doing much better since receiving a permanent heart transplant and enjoys a fairly active life, though he still has some limitations.

Taking a combination of anti-rejection medications compromises his immune system, so there’s always a risk when he’s going out to sporting events or crowded locations.

Abello said he wishes something like the Freedom Heart existed when he was first scheduled for transplant because he wouldn’t have had to go through the difficulty of more than one surgery.

“That’s everyone, even a healthy person’s, dream,” Abello said. “To have something that’s more high performance than what you have maybe. I would have begged for it.”