Like many in her field of biomedical engineering, Silvia Salinas Blemker has always been motivated by the desire to help people. Two years ago, that desire hit home when her son was born with a cleft palate.

Blemker is an associate professor with joint appointments in biomedical engineering and mechanical and aerospace engineering in the School of Engineering and Applied Science in addition to an appointment in orthopedic surgery in the School of Medicine. She recently received a 2011 Hartwell Individual Biomedical Research Award, and will use the $100,000 grant, provided over three years, on research aimed at improving the outcomes of cleft palate surgery in children.

Until her son was born, Blemker said, she probably couldn’t even tell you what a cleft palate was. The fairly common birth defect (occurring in approximately 1 in every 700 babies born in the U.S.) happens when the two plates of the skull that form the roof of the mouth are not properly joined.

“I probably would have told you that it was the same as a cleft lip,” she said. “I quickly came to realize that while a cleft palate can be combined with a cleft lip, because the opening can go all the way to the lip, they are two very different issues.”

The treatment, and outcomes, can be very different as well. “Cleft lip surgery is performed in children around two months of age and involves repairing the bones and soft tissues of the lip to restore the structure and appearance of the lip,” Blemker said.

In talking with Dr. Kant Lin, her son’s surgeon at U.Va., Blemker learned that the far more complex cleft palate surgery, generally done on children at ten months of age, is about trying to restore the muscle function in the roof of the mouth, critical to speech and to eating.

Suddenly, she thought, he was speaking her language. Blemker has spent the bulk of her career studying the physics behind muscle function, focusing on muscle mechanics to provide surgeons with a more scientific understanding of the procedures they are doing. “My work has always been inspired by a fascination for how skeletal muscle works,” she said. “I’ve always been compelled by clinical problems having to do with muscle, including a focus on disorders like cerebral palsy, where muscles are surgically altered to help movement.”

Blemker instantly found herself asking the kinds of questions she was used to asking in other application areas. “How do you know exactly how to align them?” “How long do you make them?” “What are the different surgical options, and what do those depend on?”

“I came to realize that a lot of those questions are unanswered when it came to cleft palate surgery. I also came to realize that the outcomes of the surgery aren’t great. There is at least a 1-in-4 chance that you are going to need a follow-up surgery and that patients will end up with speech difficulties for their entire lives. To some people, those odds might seem fine, but for me as a parent, these odds are difficult to accept.”

Blemker learned that there weren’t currently any engineers looking at the physics of the problem. So she reached out to The Hartwell Foundation and...
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Biomedical Engineering and Mechanical and Aerospace Engineering Professor Silvia Salinas Blemker with her son, Daniel Blemker.

recruited Lin to join a crossdisciplinary U.Va. team that would include Kathleen Borowitz, a speech pathologist; Craig Meyer, an associate professor of biomedical engineering; Talisa Altes, a pediatric radiologist; Josh Inouye, a post-doc student; graduate student Katie Pelland; and medical students Tracy Kovach and Walid El-Nahal.

The team is currently working on advanced imaging and computer modeling to provide surgeons with a framework that will allow them to better understand and predict muscle characteristics and performance both prior to and following cleft palate surgery. The ultimate goal, she said, is to create a model that can provide some new general guidelines for the surgery, or new insights that might suggest specific approaches for different types of clefts.

The entire experience has left Blemker feeling fortunate to be in the position she is in. “It feels in many ways like I was meant to do this. It has made me feel so much more informed about my son’s progress. And from a professional standpoint, I am very focused on the end goal of improving the lives of children born with cleft palates. I am hoping we can make a difference. In fact, I am banking on it.”

Blemker and her son with the crossdisciplinary U.Va. team that is working to improve cleft palate surgery.