

Grin and bear it: Dentists to test Rice University students' portable suction device

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Rice University bioengineering students really get their teeth into their senior design projects. This year, one team got everybody else's teeth into it, too.

Five Rice seniors have created a portable dental suction device, an inexpensive, battery-powered version of the vacuum system commonly used in dentists' offices to remove blood and saliva from a patient's mouth.

It's no surprise that big systems cost a lot, more than dental practitioners in developing countries can afford or even use because of limited access to electricity. For clinicians who travel from village to village to treat patients, gauze usually serves the purpose of soaking up fluids.

What is surprising is that many dentists in this country find themselves in the same situation.

Faculty at the University of Texas Dental Branch-Houston (UTDB-H) have long been aware of the need for a portable dental suction device and turned to Rice students to see how they could help.

Team Pearly Whites has come through with flying colors. Bioengineering majors Brian Benjamin, Jaime Wirth, Carmen Perez and Tiffany Kim and biochemistry and cell biology major Jessica Ma assembled a foot-operated portable system that will go on the road with UTDB-H faculty this summer for testing by rural Texas dentists. They

hope the device will eventually become a standard part of Rice's dental Lab-in-a-Backpack developed by Beyond Traditional Borders to fulfill needs in developing countries around the world.

"I can't adequately describe how motivated and enthusiastic the students were this year," said Dan Bentley, an assistant professor of restorative dentistry at UTDB-H and one of the team's advisers. "It was amazing. I think their independent effort and willing attitude have produced exactly the desired outcome for the project."

"The students evaluated the need described by their mentors at the dental branch and created a viable solution that is ready to field test," said co-adviser Maria Oden, professor in the practice of engineering education and director of Rice's Oshman Engineering Design Kitchen, where the device was designed. "The system can run without direct electrical service and should protect patients from swallowing debris during procedures, save dentists time as they perform these procedures and greatly reduce the amount of waste the team needs to dispose of -- all at low cost."

Knowing the work would have immediate impact motivated the team, which took the project on at the request of UTDB-H faculty who took Rice's dental backpack to Nicaragua last summer. "They realized that during procedures, the clinicians were using gauze to soak up saline and the blood, and they would end up with huge amounts of hazardous waste," Wirth said.

The goal was clear: The unit had to be portable, low-cost and run on alternative energy sources where AC power was limited or unavailable. It also had to handle multiple patients on one charge, use various tip sizes and prevent fluids from flowing back into the patient's mouth.

The team evaluated a number of portable vacuums and finally settled on

an 18-volt DeWalt wet/dry unit. They split the battery from the main unit and put a foot switch between the two so dentists could turn it on and off as needed without disrupting their work. All the materials for the device cost less than \$200.

Extensive testing proved the vacuum would hold up over five hours of heavy-duty use. "We would turn it on, suction 500 milliliters of water, turn it off and leave it for three minutes - and then do it again," Wirth said. "With intermittent use, we really don't see power as a problem at all."

The students built in several ways to control backflow, adding a hand-operated valve at the tip, building in L-shaped joints at the top and bottom of the hose and using tubing that won't kink. And, Ma said, "If you leave the vacuum running for a couple of seconds before you turn it off, that will clear all the liquid out of the applicator tip."

Future refinements, to be made by the senior team that takes over next year, will include streamlining the vacuum and adding the ability to charge the battery with solar or mechanical power.

Bentley certainly likes what he's seen so far. "These young bioengineers worked together, modifying and listening to our input to complete a real working prototype we can easily use," he said.

Provided by Rice University

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