



The dream team

The ability to think like both an engineer and a surgeon is the key to the success of Dr. Victor Yang's cutting-edge work at 7D Surgical. Yang is a Canada Research Chair in Bioengineering and Biophotonics at Ryerson and a neurosurgeon at Sunnybrook Health Sciences Centre. He's the co-founder of 7D Surgical, a specialized medical device that enables surgeons to perform delicate procedures to repair spinal injuries, and remove brain tumors with far greater accuracy, speed and safety. "Certain 'aha' moments only

happen when both sets of knowledge are in one brain," says Yang.

When Yang was doing his neurosurgical residency in 2008, he was amazed that a master surgeon knows exactly how and where to safely insert a screw into a spinal vertebral that lay hidden below the surface, based on limited visible surface features and the patient's CT scans.

Frustrated with the limitations of existing surgical navigation systems, Yang thought there had to be a better way for all surgeons to *actually* see the entire surgical site, including subsurface features, in real time by using a computer with an optical 3D imaging system. "I wanted to give people the vision of a master surgeon," he says.

So in his Bioengineering and Biophotonics research lab at Ryerson, Yang devised a new, radiation-free optical imaging technology for surgical navigation. The system is embedded in an operating room overhead surgical light filled with LEDs (light emitting diodes), which shines a sequence of light onto the surgically exposed surface at very high speed. The computer captures the light reflecting off the surgical site's surface and rapidly calculates its three-dimensional shape; this is called topographical imaging. The computer matches the surface information with data from the patient's MRI/CT scan, producing, in real time, a detailed, 3D map of the patient's anatomy, including subsurface information, which the surgeons can use as they operate.

"All surgeons are trained to use a surgical operating room light and we were able to build the system with inexpensive, off-the-shelf components, such as computer projectors and cameras, to keep manufacturing costs low," Yang says.

He co-founded 7D Surgical in 2009, with a Ryerson team that includes Beau Standish and Adrian Mariampillai (his former post-doctoral fellows who are now CEO and CTO), researcher/engineer Michael Leung and scientist Peter Siegler, to fabricate the system and commercialize the technology. "Having strong personal drive is important to be a successful entrepreneur. But unlike some entrepreneurs, who want to do it all themselves, I knew

I needed the right team. We had a big team to start the company, with great skills, and everybody shares the same dream," says Yang.

7D Surgical, which now employs 30 people, has received more than \$10-million in private investment, including seed funding from about a dozen investors from the Ryerson Angels Network, and about \$1-million from FedDev Ontario to bring its game-changing surgical navigation system to market.

"Ryerson encourages inventors to commercialize their inventions and make it all happen. Without Ryerson's support and those angel investors who took the early risk with a startup company, we couldn't have done it," says Yang.

The prototype device has been used in clinical trials in 170 surgical procedures at Sunnybrook hospital. "Preliminary research shows that our system is as accurate as existing devices and much faster, which helps speed up surgical workflow," says Yang. "The most rewarding thing for me is the patients we've helped through the clinical trials. We had one young woman who fell off a rooftop while working in construction. She had two broken vertebrae and a fractured spine, and she couldn't walk. The surgery was very successful and 10 days later she walked down the aisle with a surgical bandage sticking out of her wedding dress," says Yang.

By January 2017, 7D Surgical won FDA clearance and Health Canada approval. "We expect to make the first few sales this spring. In the next few years, we're aiming to penetrate the U.S. market and parts of Canada, and then look to expand. We truly believe it is a disruptive technology that would benefit all spinal and brain surgery patients and beyond," Yang says. ●

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CANADA RESEARCH CHAIR,
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