

3D PRINTING HELPS MAKE LIGHTER, MORE ROBUST KNEE BRACES FOR ELDERLY PATIENTS, SINGAPORE NEWS & TOP STORIES

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SINGAPORE – Similar to a slim knee brace that Batman used in the movie *The Dark Knight Rises*, a new aid called the X-Brace offers a leg for those suffering from knee problems.

The lighter and more robust knee brace for the elderly was developed in collaboration between a local engineering firm, knee surgeons and 3D printing specialists from Nanyang Technological University (NTU).

Knee braces are usually prescribed to older patients to relieve their joints and to help patients who have undergone knee surgery – for example, if they have torn ligaments.

Dr. Jeffrey Chew, an orthopedic surgeon at the Center for Orthopedics, noted that a common condition in elderly patients is knee osteoarthritis –

1; “wear and tear” of the knee joints – which affects 40 percent of people over 70.

“Knee osteoarthritis can significantly affect the quality of life and lead to daily pain, weakness and instability,” he said on Wednesday (December 15) in a media preview of the knee brace.

Traditional knee braces weigh about 1 kg and are designed to limit movement by preventing the knee from bending past a certain angle, noted Dr. Chew.

“That’s why we wanted to create a lighter knee brace that would also help the patient move, especially for those who have difficulty getting up, walking or climbing stairs due to weak and sore knees,” he added. ^

In 2017, Dr. Chew told Mr Fabian Ong, General Manager of the local Delsson Singapore engineering company, to develop a design. Delsson worked with NTU on the prototyping process and product design iterations using 3D printing.

The team finally reduced the weight of the orthosis to around 720 g – 30 percent lighter than the conventional exoskeleton knee orthosis. It is made of plastic instead of the typical metal orthopedic braces that weigh more than 1 kg.

The X-Brace contains a spring that allows the user to lift 3kg to 6kg while standing or walking, Mr Ong said.

“The support is twofold: on the one hand, it gives (users) a lift to make up for their lack of strength, and on the other hand, it also gives them the confidence to walk again, which helps them recover faster,” he added.

The orthosis can be adapted to the needs of each patient.



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ST PHOTO: MARK CHEONG

Dr. Chew said, "The idea is to gradually wean the patient off the orthosis so that the doctor or physical therapist can also adjust the strength of the orthosis when (the patient) recovers."

Dr. Ho Chaw Sing, co-founder and general manager of the National Additive Manufacturing Innovation Cluster (Namic), a platform led by NTU's innovation and enterprise company NTUitive, said 3D printing is extremely useful for rapid prototyping and light, complex ones Designs. making the technique helpful for this particular project.

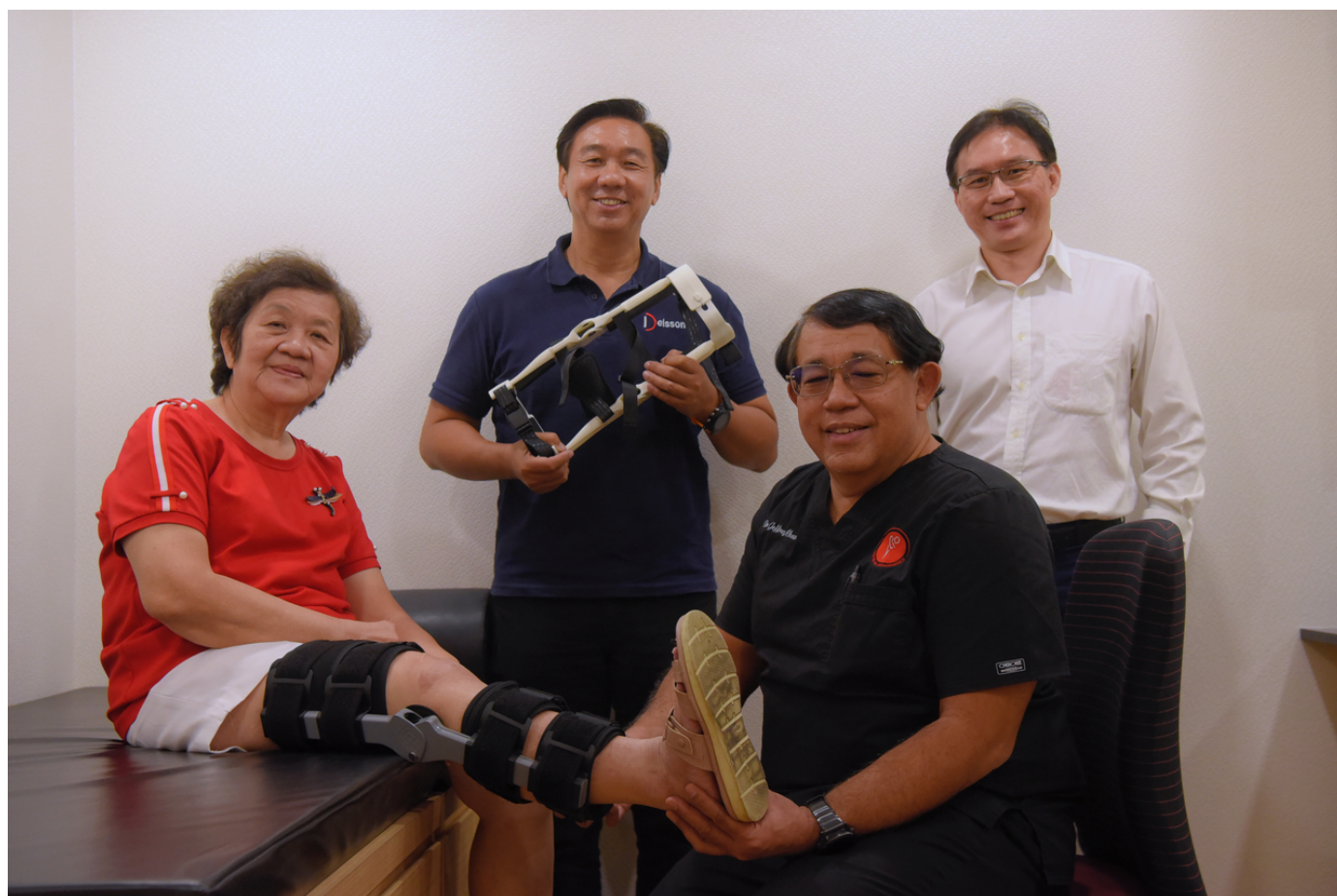
He added that Namic has supported more than 240 projects in the past six years, of which more than 60 are healthcare-focused.

NTU Assistant Professor Chan Wai Lee of the School of Mechanical and Aerospace Engineering, who is the lead researcher on this project, said 3D modeling was used heavily to validate the various design ideas that led to the orthosis reducing weight.

Mr. Joel Lim, a PhD student on Prof. Chan's team, led the design effort in conversation with Delsson and printed the prototype in 3D for real-world validation tests.

"Lightweight and strength are crucial in this project. We first analyzed conventional knee orthoses and their current parts list.

"We made the decision to switch to a plastic material with an optimized structure ... and then we designed new structures and joints that were strong enough to withstand the flexion of the knee while still helping it point in the right direction move,"said Mr. Lim.



(From left) Madam Teo Lee Lee, Mr Fabian Ong, Dr. Jeffery Chew and Dr. Ho Chaw Sing. ST PHOTO: MARK CHEONG

At least 10 people have tried the orthosis so far, including Madam Teo Lee Lee, 72, who suffers from osteoarthritis and needed two knee replacements last year.

After the operation, her right leg was still very weak and she had difficulty walking. None of the traditional knee braces worked on her until she tried X-Brace.

“I feel much safer when walking with the orthosis and have less difficulty getting up compared to before,” said the pensioner.

The X-Brace is expected to hit the market shortly for \$ 1,000 – the equivalent of the cost of traditional knee braces – although the price may vary based on the user’s needs.

The team is working on its next version of the product – reducing the weight of the orthosis to 600g by incorporating a slimmer design that can be worn under clothing.

The new version is expected to hit the market in the first quarter of next year, Ong said. “In the future, we hope to develop a smart knee brace – equipped with electronic sensors that quantitatively measure whether the patient is doing better,” he added.