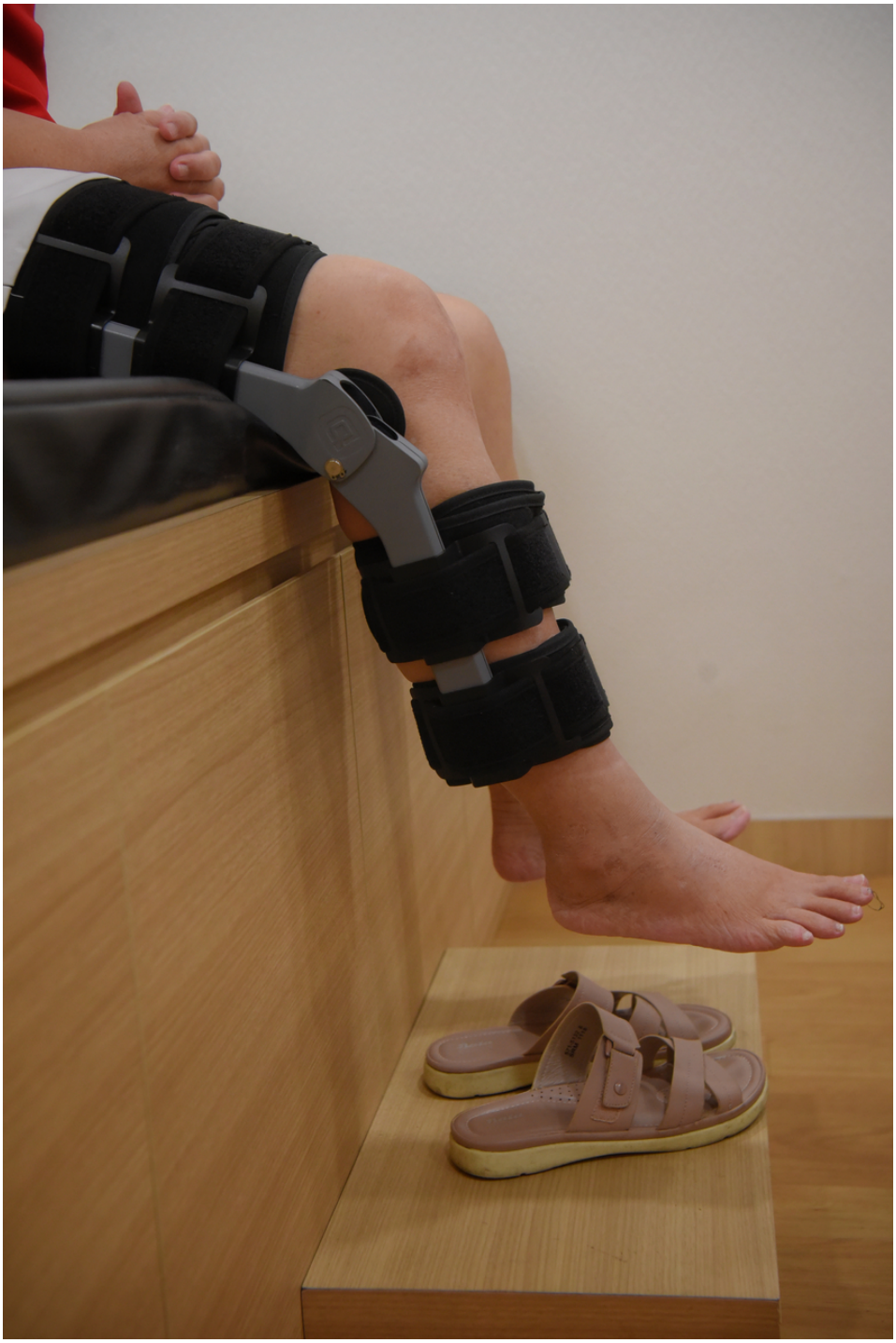
3D Printing Helps Create a Lighter, Stronger Knee Brace for Elderly Patients, Singapore News and Featured Stories

5 min read

13 hours ago Gilberta Tostado



SINGAPORE - The sleek knee brace that Batman wore in The Dark Knight Rises is similar to a new brace called the X-Brace that offers a knee brace for those with knee problems.

Aiming for the elderly, the lightest and strongest knee brace was developed in collaboration between a local engineering company and knee surgeons and 3D printing specialists from Nanyang Technological University (NTU).

Knee braces are generally prescribed to elderly patients to ease the load on their joints and help patients who have undergone knee surgery, for example torn ligaments.

Dr. Jeffrey Chiu, an orthopedic surgeon at the Orthopedic Center, noted that a common condition among elderly patients is knee osteoarthritis ("wear and tear" of the knee joints) that affects 40 percent of people over the age of 70 years.

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

Dr. Chiu noted that traditional knee braces weigh about 1 kg and are designed to restrict a person's movement by preventing the knee from bending beyond a certain angle.

"So we wanted to make a knee brace that was lighter, but also supported the patient when moving, especially those who have difficulty standing, walking or climbing stairs due to weak and painful knees," he added.

In 2017, Dr. Chiu approached Fabian Ong, CEO of local engineering firm Delsson Singapore, to present a design. Delsson worked with NTU on the prototyping process and product design iterations using 3D printing.

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The team ultimately reduced the weight of the brace to around 720 grams, 30 percent lighter than a conventional exoskeleton knee brace. It is made of plastic, rather than the typical metal braces that weigh more than 1kg.

The X-Brace includes a spring that provides 3kg to 6kg of lift to the user when standing or walking, Mr. Ong said.

“The support provided is twofold: on the one hand, (the users) are given a boost that compensates for their lack of strength and, on the other hand, they are also given the confidence to walk again, which helps them recover faster. ". added.

The corset can be customized according to the needs of each patient.

The brace is made of plastic, rather than the typical metal braces that weigh more than 1kg. ST Photo: Mark Cheung
"The idea is to gradually remove the patient from the stent, so that the doctor or physical therapist can also adjust the strength of the stent when (the patient) recovers," said Dr. Chiu.

3D printing is very useful for rapid prototyping and complex lightweight designs, making the technology useful for this particular project, said Dr.

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

3D modeling was used extensively to validate various design ideas that reduced the weight of the strut, said NTU Associate Professor Chan Wai Lee from the School of Mechanical and Aerospace Engineering, who is the principal investigator on the project.

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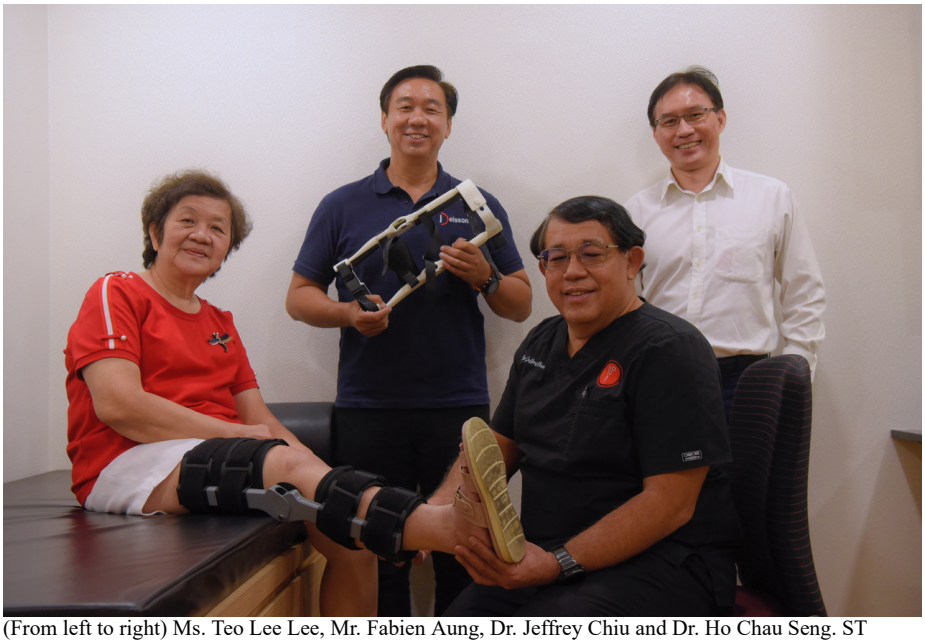
Joel Lim, a PhD student on Professor Chan's team, led the design effort in a discussion with Delsson and printed a prototype for 3D validation tests.

“Light weight and strength are essential for this project. We first looked at conventional knee braces and the current bill of materials.

“We decided to switch to a plastic material with an improved structure… then we designed new structures and joints that are strong enough to support the flexion of the knee and still help it move in the right direction,” said Mr. Lim.



(From left to right) Ms. Teo Lee Lee, Mr. Fabien Aung, Dr. Jeffrey Chiu and Dr. Ho Chau Seng. ST Photo: Mark Cheung

So far, at least 10 people have tried the brace, including 72-year-old Mrs. Teo Li Li, who has osteoarthritis and needed a knee replacement last year.

After the surgery, his right leg was still very weak and he had trouble walking. None of the traditional knee braces worked for him, until I tried the X-Brace.

"I feel more confident walking with the brace and I have less difficulty standing than before," said the retiree.

The X-Brace is expected to be available on the market soon for $ 1,000, the equivalent of the cost of a conventional knee brace, although the price may vary depending on the user's needs.

The team is working on the next version of the product: reducing the weight of the brace to 600g by incorporating a sleeker design that can be worn under clothing.

Ong said the new version is likely to be released in the first quarter of next year. "In the future, we hope ... to create a smart knee brace, equipped with electronic sensors to quantitatively measure whether a patient is improving," he added.