

By E&T editorial staff

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Scientists have developed a light, robust knee brace that can be made using 3D printing techniques.

Developed by Singapore engineering firm Delsson, in collaboration with 3D printing specialists from Nanyang Technological University (NTU), Singapore, the X-Brace is around 30 per cent lighter than traditional exoskeleton knee braces.

The weight savings were achieved thanks to a new 3D-printed design that uses lightweight plastic and assistive springs instead of metal. It weighs about 720g - 30 per cent lighter than the typical metal orthopaedic braces that can weigh over 1kg.

Braces are often prescribed to elderly patients to help alleviate the burden on their knee joints, as well as to assist patients who have undergone surgery on their knees, such as reconstruction of torn ligaments, often suffered by athletes.

The researchers used 3D-modelling to help validate their design ideas and enable them to achieve the significant weight reductions.

"Lightweight and strength are crucial to this project. We first analysed the conventional knee braces and their current bill of material. We decided to change to a plastic material with optimised structure. Using topology optimisation with a delineated stress map and 3D modelling, we then designed new structures and joints that are strong enough to withstand the flex of the knee and still assist it to move in the correct direction," explained Joel Lim, an NTU PhD student who led the design efforts.

The researchers believe the X-Brace could help to change the way doctors and physiotherapists treat and manage different knee conditions, given that the amount of assistance given by the brace can now be customised, from 6kg to 32kg of force.

"X-Brace will be revolutionary for patient recovery. It is lightweight and does not slip, while its modular assistance load allows patient recovery to be individualised. NTU's help in providing a quantitative methodology to reduce wall thickness and profile of the frame was crucial in achieving the weight reduction after several reiterations," said Fabian Ong, executive director of Delsson.

While the purpose of a conventional brace is to keep the knee unflexed and restrict the movement of the knee by stopping the user from bending the knee beyond a certain angle, the modular design of the Exo-brace allows patient recovery to be based on exercising the knee after surgery.

Since everyone recovers at a different pace, the tension of the spring and the location of the spring (left, right, or both sides) on the brace is decided by the doctor or physiotherapist to best provide the needed support, while allowing the patient to recover at his or her own pace by daily movement.

3D printing is increasingly being used in healthcare settings. Last month, a man from Hackney in East London became the first person in the world to have [a 3D-printed prosthetic eye](#) inserted into his socket.