

# Technology Frontier

News Bite on PolyU's Innovation

## Leg Guarder Kit

Custom-made leg support that prevents and treats varicose veins and knee pain

Varicose veins and knee pain are common ailments among the ageing population. But there has not been a single solution that addresses both problems until researchers from the Department of Rehabilitation Sciences and the Institute of Textiles and Clothing came up with a novel leg support system known as Leg Guarder Kit – basically custom-made compression stockings and a knee brace. Not only are they more effective than off-the-shelf products in curing and preventing varicose veins and knee pain, they also offer more wearing comfort.



Dr Xia Guo (right) and Dr Rong Liu

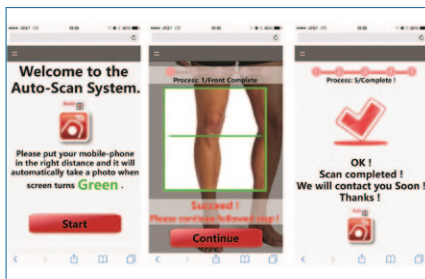
Pregnancy, excess weight, and standing for long hours exert pressures on leg veins and extra loading on knee joints. These factors may also lead to Chronic Venous Insufficiency (CVI) and knee pain. So far, there has not been a single solution addressing both CVI and knee pain until Dr Xia Guo, Associate Professor, Department of Rehabilitation Sciences and Dr Rong Liu, Assistant Professor, the Institute of Textiles and Clothing invented a novel orthosis known as Leg Guarder Kit. In future, users may even take photos of their legs and upload them via a smartphone app to have Leg Guarder Kit precisely made to their measurements.

### CVI and knee pain in ageing population

Chronic Venous Insufficiency refers to the malfunction of valves in the veins that causes swelling, pain and varicose veins in the legs. Most CVI patients also suffer from knee pain. Dr Guo said, "Our clinical survey revealed that 60% of the respondents over age 45 reported symptoms of CVI and knee pain simultaneously. Generally speaking, patients with CVI and knee osteoarthritis are advised to wear compression stockings and knee braces to improve venous blood flow and support their knees. However, off-the-shelf products may worsen their symptoms."



Leg Guarder Kit



Digital body scanner and online data input system for customers



Leg Guarder Kit won a bronze medal in the 44th International Exhibition of Inventions of Geneva.

## Precise degressive gradient compression

So, what is wrong with compression stockings you get from drug stores? First off, you need to understand how they work. "To enhance venous blood flow in the legs, a gradient compression is needed. The further away it is from the heart, the stronger the applied pressure should be. A steadily decreasing pressure from the ankle to the thigh would direct the blood to flow back from the foot to the heart. However, this pressure gradient cannot be guaranteed with off-the-shelf hosiery because not everyone has the same standard leg shape," explained Dr Liu. For instance, a person with bigger calves may experience a stronger pressure on the calves than on the ankles. That could worsen venous blood flow by pushing the blood back onto the feet. "The only way to ensure precise pressures at the right points is to scan their legs and make the stockings to measurements. Then the subjects try on the stockings in our labs to check if the pressures are appropriate." In future, users may upload photos of their legs from different angles via a smartphone app and the custom-made stockings will be ready in one week.

## Bi-axial elastic tension

Apart from functional concerns, wearing comfort also matters. Most patients complain about the

unbearable heat and itch under regular compression stockings. The difficulty and the time required to put them on and take them off also discourage some patients from using them. According to Dr Liu, "Most off-the-shelf stockings are made with industrial materials that might cause allergic reactions. On the other hand, Leg Guarder Kit is made with biocompatible medical-grade materials that are hypo-allergic and breathable. That means they are a lot more comfortable than regular compression stockings."

Seamlessly made with advanced 3D hybrid weft knitting technology, Leg Guarder stockings provide more wearing comfort than regular compression stockings with seams. What's more, the stretching force is stronger along the width of the stockings, but less strong along the length. "That's why they can be put on and taken off easily, while still providing the right amount of pressure on the legs," explained Dr Guo. Better still, Leg Guarder stockings last up to 200 machine washes without losing its wearing performance. "That works out to last for 6 months with daily washes," added Dr Liu.

In April 2016, Leg Guarder Kit won a bronze medal in the 44th International Exhibition of Inventions of Geneva, Switzerland.