新一代智能壓力衣
高科技治療增生性疤痕

壓力治療能有效平復及軟化因燒傷而引致的增生性疤痕，但一直以來，並沒有
科學研究能精確計算出治療疤痕所需的壓力。香港理工大學康復治療科學系副
系主任李慧平教授解釋：「在香港被燒傷的病人不算多，但在其他亞洲國
家，燒燙傷仍然是嚴重的健康問題。例如在中國，每年有超過三十萬人被燒
傷，其中不少是大面積燒傷。身體上的痛楚經已不容易面對，傷口痊癒後，傷
者還要努力克服因疤痕及傷處變形而引起的心理不安。故此，研發價錢合理、
而且有效平復增生性疤痕的壓力治療輔具，實在非常重要。」李慧平教授亦
因此發明了全球首創的「智能壓力衣」。

增生性疤痕保守治療法
增生性疤痕指傷口癒合後，傷處變得肥厚或膚色變深，明顯與其他皮膚有異。李慧平教授稱：「目前，以保守
治療法處理增生性疤痕還是較為普遍，例如醫生可於傷處注射類固醇，以減慢疤痕增生。可是類固醇有不少副作
用，如色素沉澱及傷處可能萎縮。此外，矽膏去疤貼亦可軟化疤痕，但對範圍較小的手術疤痕比較有效。對於範
圍較大的燒傷疤痕，壓力治療仍然是最有效的療法。」
壓力治療

李曾慧平教授指出，一如不少大搞發明，壓力治療的發明，最初也是出於偶然。「據稱在美國哈佛大學醫學院屬下的Shriners Centre，醫護人員發現傷口被繃帶緊緊包紮的病人，傷口癒合後的疤痕明顯比較滑平。自此，醫護人員就以Lyca免洗衣物反覆覆蓋治療增生性疤痕的效果；壓力太小無效；壓力太大又影響疤痕的血液循環。所以我們需要以科學化及標準化的方法，計算治療不同增生性疤痕的理想壓力，並不斷監察控制壓力，達至最佳治療效果。」這就是她研發智能壓力衣的背後理念。

「智能壓力衣」

「以往接受壓力治療的傷者有兩個選擇：美國製的高價壓力衣，全套約售$2,000美元；或中國製的平價壓力衣，但衣料透氣度、彈力度、耐用度及稱身度均強差人意。試想像要每天24小時穿戴這種壓力衣，一定相當難受。」李曾慧平教授解釋道。那麼度身訂造的智能壓力衣與市場上的類似產品有什麼不同？首先智能壓力衣選用專利布料，產生足夠彈力之餘，強韌耐用、質地平滑，而且透氣舒適。其次智能壓力衣的製造過程全面電腦化，病人體形由立體電腦掃描器分析，然後數據輸入至電腦紙樣裁床，由度身至裁剪紙樣只須數秒，大大節省人力及生產時間達十分之九。李曾慧平教授回憶道：「還記得從首次治療時，每天總有上下數百訪為病人準確度身及裁剪紙樣。在這個資訊科技發達的年代，為什麼還要這類低產量的工地上費人力？」最後智能壓力衣打破了以往沒完沒了的反覆試穿模式，醫護人員已準確地計算出智能壓力衣需要產生的壓力，並以精密儀器監控疤痕所承受的壓力是否合適，以便修改壓力衣，甚至於適當的部位加上厚墊，加強緊貼皮膚的效果。」

「智能壓力衣」的商業價值

作為增生性疤痕的醫療康復輔具，智能壓力衣的商業價值當然不容置疑，但它的發展潛力亦不止於此。運用智能壓力衣的原理及原料，還可造成高壓氧機，有助預防及舒緩靜脈曲張及深層靜脈栓塞性塞。不少人誤以為靜脈曲張只是外觀問題，對健康無礙，但嚴重的靜脈曲張可引起疼痛或癢癢。現在我們正仔細研究香港人的腳部尺寸，希望在不久將來可推出6至9種不同尺碼的壓力繃，讓腳部長度及腳圍不同的男女，都能穿著稱身耐用的壓力繃。此外，內分泌出現問題或於接受癌症手術後，病人可能有淋巴水腫的情況，穿著智能壓力衣亦能有效改善水腫。」

特別賀謝：香港理工大學康復治療科學系副系主任李曾慧平教授
A new generation of pressure garment: Smart Pressure Monitored Suit (SPMS)

Pressure therapy is an effective means to treat post-burn hypertrophic scars, but there has not been any scientific research done to determine the exact pressure needed for effective treatment of different scar conditions. "Burn injury is still a major health issue in many Asian countries, including Mainland China. Each year, there are over 300,000 clients suffering from burn injury in China and many of them have large surface of burns. After surviving the physical complications, clients still have to deal with the emotional distress due to scarring and deformities. That's why it's important to develop pressure therapy intervention in controlling hypertrophic scar at reasonable cost," explained Professor Cecilia Li-Tsang, Associate Head of the Department of Rehabilitation Sciences, the Hong Kong Polytechnic University, who is also the principal investigator behind the groundbreaking Smart Pressure Monitored Suit (SPMS) project.

Conservative treatments on hypertrophic scars
A hypertrophic scar is one that is swollen, puffy, and reddened, causing it to stand out from the surrounding skin. Professor Li states, "Conservative treatments are usually used first to handle hypertrophic scars. A doctor may inject intralesional corticosteroids to retard the growth of hypertrophic scar but it is associated with many side effects such as uneven pigmentation and atrophy of the affected area. Silicone gel dressing can also be applied on hypertrophic scars to soften the scar. Yet, they are more effective on small surgical scars than large-area wounds associated with severe burn injuries, in which cases pressure therapy is still the most effective treatment."

Pressure therapy
According to Professor Li, pressure therapy was a result of serendipity. "Sources have it that the Shriner's Centre, the Harvard Medical School, happened to discover only clients who had bandages tightly wrapped around their burn wounds showed flattened scars. Since then, pressure therapy has been provided on a trial and error basis using elastic garment (lyca net materials). However, applying too little pressure lessens the treatment effect while too much pressure may hinder blood circulation in the scar tissue. Therefore, it would be helpful to develop a scientific approach to find out the optimal loading onto different scar tissue and keep monitoring the pressure applied," she accounted for the rationale behind the development of the SPMS product.
Smart Pressure Monitored Suit (SPMS)

"Burn clients used to have two choices: pricey pressure garments from the U.S. which cost over US$2,000 for a whole suit; or those cheaper ones made in Mainland China with low quality fabric and non-fitted garments. Imagine how it feels to be in such a suit 24-7," said Professor Li. So, how is the custom made SPMS different from other garments available in the market? Firstly the patented fabric is specially designed to generate pressure while being resilient; durable and comfortable. Secondly, from measurement to pattern making, the production of SPMS is fully computerized so as to provide accurate fitting garment pattern, while saving time and labour. I used to be a therapist myself and I remember spending hours on measuring and tracing the pattern on paper," she recalled. "Why should we waste expensive man-hours on something that can be taken care of by a computer?" With the introduction of SPMS, specific measurements of a human body could be obtained with a 3D scanner and converted into patterns of 3D tailoring within a matter of minutes, thus shortening the whole production lead time by nine-tenth. Finally, pressure applied to the scars can be accurately monitored and verified after fitting. "An expensive and highly sensitive system called the Pliance-x system is used to measure the interface pressure loading generated on the scars. Most pressure garment manufacturers cannot afford the system and they can never verify if the pressure is optimally applied to different parts of the body." On top of that, SPMS also has a competitive edge in terms of cost concerns. "A full-body SPMS is estimated to cost somewhat from HK$2,000 to 3,000 which is only a fraction of its U.S. counterpart but exhibits better fitting and verifiable pressure on the scar tissues."

Commercial value of SPMS

Owing to its competitive pricing and monitored pressure, SPMS carries a high commercial value as a medical or therapeutic device for hypertrophic scars. But the potential of SPMS does not stop there. Other applications include compression stockings for prevention or improvement of varicose veins and deep vein thrombosis. "We are currently conducting a research on foot sizes of Hong Kong people. Hopefully, a range of 6 to 9 sizes of pressure stockings and socks will soon be manufactured to fit local men and women with different foot lengths and widths. Moreover, clients suffering from lymphoedema (i.e. fluid retention) due to poor lymphatic circulation would also benefit from wearing SPMS." "Clothing & Accessories"

Measurements of a client are analysed by a 3-D scanner and converted into patterns right away.

Patented fabric is cut and sewn in a three-dimensional manner for perfect fit and comfort.

Acknowledgement:

Professor Cecilia Li-Tang, Associate Head of the Department of Rehabilitation Sciences, the Hong Kong Polytechnic University.