Summary

The aim of the doctoral dissertation was to develop a computer-aided method of designing ready-made and seamless compression products for external therapy of phlebological diseases and scar pathologies: post-burn, post-traumatic and post-operative. The development of product design algorithms was preceded by modeling the impact of the following factors on the unit pressure value: tolerance of silhouette dimensioning and product manufacturing tolerance, selection of tensile stiffness of compression knitted fabric to pressure class, seam presence, perimeter geometry and body susceptibility to compression.

Based on the results of the analyzes performed, a significant impact of the above factors on changes in the value of the unit pressure was found. Research related to the replacement of manual measurement of the patient's silhouette with the 3D scanning technique led to the conclusion that the measurement of the silhouette in the initial compression garment reduces the impact of soft tissue susceptibility on the intended unit pressure value. In addition, an experimental evaluation of the design correctness of medical, seamless, standardized, offered on the market compression products for I and II compression class was carried out.

The conducted research on the properties of compression knitted fabrics led to the development of generalized mechanical characteristic of knitted fabrics in the form of a relationship of strength and relative elongation, which integrates force values for different stretching ranges within the limits of useful elongation. The introduction of the above-mentioned relationship between force and relative elongation, as well as measurement data from scanning body parts using the 3D technique and Laplace's law, into the design algorithm was the basis for the method of designing compression products.

Finally, using algorithms, an improved method of designing personalized, ready-made and seamless compression products in a relaxed state was presented, taking into account the aggregated conditions of changes in unit pressure, and examples of products designs with a constant and graduated value of unit pressure for various classes of compression.

Keywords: compression products, unit pressure, Laplace's law, 3D scanning, product design algorithms.