

SIMULATION/MODELISATION OF THE ACTION OF COMPRESSION BANDAGES ON THE LOWER LEG

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Introduction – Compression bandages are commonly used in the treatment of some venous or lymphatic pathologies. The success of the treatment relies on the applied pressure, which depends on several parameters related to the bandage but also to patients' morphology. A previous experimental study showed that patient's morphology and bandage elastic properties were not sufficient to explain interface pressure distribution [1]. However, these two parameters are the only one taken into account in Laplace's Law, actual reference method to explain interface pressure distribution.

Objective – To characterize and model compression bandages pressure generation mechanisms

Methods – A patient-specific numerical simulation of 4 bandages application (Biflex® 16 and Biflex® 17 (Thuasne) applied with 2 and 3 layers on the leg) was developed for 5 subjects. The inputs of this simulation are the subjects' morphology, the bandage elastic properties and the application technique. The results of this simulation were then confronted to the experimental results and pressure values computed with Laplace's Law:

$$P = \frac{nT}{r}, \quad T > 0, \quad r > 0$$

with P the pressure [$N.mm^{-2}$], n the number of layers, T the bandage tension [$N.mm^{-1}$] et r the local radius of curvature [mm].

Results – The numerical simulation provides the complete pressure distribution over the leg but also considers the deformations of the leg, induced by bandage application. The comparison with the results given by Laplace's law highlighted the influence of these leg geometry changes on the applied pressure. However, the 4 parameters considered in this simulation (leg morphology and deformations, bandage mechanical properties and application technique) are not sufficient to completely explain pressure generation, and differences with the experiments still persist.

Discussion – Numerical simulation still need to be enriched to consider other parameters which may impact interface pressure such as bandage to bandage interaction for example.

References

1. Chassagne et al, *Ann. Biomed. Eng.*, 43:12: 2967–77, 2015