

# **Design and development of an air pneumatic compression device for an irregularly-shaped model lower leg**

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## **Context**

Air pneumatic compression is a treatment used on the lower extremities of patients for management of venous disease including oedema. Air pneumatic compression device (APCD) consists of an inflatable bladder with one or more pressure chambers/sleeves that encircles the limb or part of the limb. The shape at different positions of the lower limb (i.e. calf (gastrocnemius), below calf (soleus), ankle), and radius of curvature at any cross-section of the lower limb (i.e. anterior edge of the tibia bone, calf) is irregular. Thus, designing and fabricating an APCD which could fit the irregularly-shaped lower leg is challenging but essential. Also, the inflatable sleeves should remain inflated (by ensuring no air leakage occurs during therapy), so the recommended pressure remains over the lower leg. The existing design of the pneumatic device/s do not consider the shape, and size of the irregular lower leg.

## **Aim**

The aim of this work was to design, and develop an APCD for an irregularly-shaped model lower leg.

## **Materials and methods**

Compression sleeves were fabricated using silicone sheets. The patterns for inner and outer layers of pneumatic compression sleeves for three different positions of lower limb i.e. ankle, below calf, and calf were optimised and created using a combination of drape and flat pattern techniques. Various modifications to the sealing/bonding of the edges of inner and outer layers of compression sleeves were performed to ensure no air leakage occur from the pneumatic sleeves. The reduction in pressure over time (with different levels i.e. 0 min, 5 min, 10 min, 15 min, 20 min, 30 min, and 60 min) from these modified sleeves were measured and plotted.

## **Results and conclusion**

An acceptable air tight silicone based pneumatic compression sleeves were fabricated, which can accommodate a three-dimensional curved lower leg. The developed compression device was approximately 50% lighter in weight than a similar commercially available pneumatic compression device. Further refinements in designing of sleeve are recommended.