

## External Intermittent Compression Increases Collateral Artery Number and Size Following Femoral Artery Occlusion

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**OBJECTIVES:** External intermittent pneumatic compression therapy has been found to be efficacious for increasing claudication walking distance in ulcer healing in patients with inoperable peripheral vascular disease. The underlying mechanism has not been defined but has been proposed to be that of vascular remodeling in response to the increased shear-stress following increased blood flow with inflation/deflation of pneumatic compression. We tested the hypothesis that intermittent compression induces an increase in both collateral artery number and size in a rabbit-model following femoral artery occlusion.

**METHODS:** New Zealand adult white male rabbits (n=8), aged at least 2-years and with a weight of at least 4.0 kg, underwent bilateral superficial femoral artery ligation. Beginning on post-operative day 1, the experimental leg underwent 60 minutes of daily intermittent compression for a ten week period utilizing the ArtAssist device with a 3 sec 90 mmHg pressure inflation and a cycle of 3 times per minute. The control limbs were not treated with compression. At the end of the ten week period, high-resolution angiograms (Kodak MIN-R2 film) were obtained by barium infusion into the aorta. The angiograms were analyzed in a blinded manner and the number of collateral arteries larger than 100 microns in diameter, in a circumscribed midsection of the thigh, were counted. Following perfusion fixation at arterial pressure, histological specimens of transverse sections of the semi-membranous muscle were examined to find the largest collateral arteries. Digital histological images were later blindly examined and vessel wall-thickness was measured.

**RESULTS:** All animals tolerated daily compression without the need for medication or anesthesia. The experimental limbs treated with compression demonstrated a significantly greater number of collateral vessels, ranging in size from 100-700 microns, as compared to controls. The mean size of collaterals in the limbs treated with compression was also significantly larger:

	Total Number of Collateral	Collaterals per Limb	[Luminal] Size (mm)	Vessel Thickness (_m)
Control	49	6.1±0.9	0.30±0.02	37±3
Experimental	69	8.6±0.8	0.38±0.02	34±4
p-Value	<0.005	<0.005	<0.001	0.57

Microscopic examination of the collateral demonstrated normal features, with well-developed medial and adventitial layers. The measured collateral wall-thickness between treated and control side were not significantly different.

**CONCLUSIONS:** A ten-week period of daily intermittent compression increases both the number and size of collateral arterial vessels. The clinical significance is that these results support the use of compression therapy to increase collateralization in patients when direct arterial reconstruction is not feasible.

