



ARTERIAL STUDIES

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CALF MUSCLE STIMULATION WITH THE VEINOPLUS® DEVICE, RESULTS IN A SIGNIFICANT INCREASE IN LOWER LIMB INFLOW WITHOUT GENERATING LIMB ISCHEMIA OR PAIN IN PATIENTS WITH PERIPHERAL ARTERY DISEASE

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Objective: Increase in arterial inflow to the lower limbs is important to obtain functional improvement in peripheral artery disease (PAD) patients with claudication. The aim of this study was to assess the effect of electrical stimulation of calf muscles on arterial inflow and tissue oxygen content in PAD in the area of stimulation.

Methods: Fifteen adult patients [mean (standard deviation) age, 62 (12) years; height, 165 (8)cm; weight, 76 (13) kg; lowest ankle-brachial index 0.66 (0.19)] with stable arterial claudication were recruited. All patients performed a treadmill test (3.2 km/h, 10% slope) associated with a transcutaneous oximetry test expressed as decrease from rest of oxygen pressure (DROP) index values (calf changes minus chest changes from rest) with a maximum walking distance (median [25th/75th percentiles]) of 295 [133-881] m. The DROP index on the symptomatic side was -25 [-18/-34] mm Hg. On another day the patients underwent electrical stimulation in the seated position on the leg that was the most symptomatic on the treadmill. After resting values were recorded, the gastrocnemius was stimulated for 20minutes at increasing contraction rates at 5-minute steps of 60, 75, 86, and 100bpm on the most symptomatic side. Arterial blood inflow with duplex Doppler ultrasound scanning of the femoral artery, DROP transcutaneous oxygen pressure value, and oxygen concentration (O₂)Hb from the near-infrared spectroscopic signal of the calf were recorded on both sides. Patients were instructed to report eventual contraction-induced pain in the stimulated calf. Results are given as mean (standard deviation) or median [25th/75th percentiles] according to distribution, and the level of statistical significance was set at P < .05 on two-tailed tests.

Results: Lower limb inflow (mL/min) was 64 [48/86] vs 63 [57/81] (P> .05) before stimulation, 123 [75/156] vs 57 [44/92] (P < .01) at 60bpm, 127 [91/207] vs 49 [43/68] (P < .01) at 75bpm, 140 [84/200] vs 57 [45/71] (P < .01) at 86bpm, and 154 [86/185] vs 55 [46/94] (P < .01) at 100bpm on the stimulated vs nonstimulated limb, respectively. No apparent decrease or significant leg difference was observed in DROP index or O₂)Hb values. None of the patients reported contraction-induced pain in the leg.

Conclusions:

Electrical stimulation of calf muscle with the Veinoplus device results in a significant increase of arterial inflow without measurable muscle ischemia or pain. Potential use of this device as an adjuvant treatment to improve walking capacity in PAD patients remains to be evaluated.

Key words: Transcutaneous oxygen pressure, Claudication, Arterial disease, Near infra-red spectroscopy, NIRS, Electrical muscle stimulation, EMS.