EFFECTS OF ANKLE-TO-KNEE EXTERNAL PRESSURES ON SKIN BLOOD PERFUSION UNDER AND DISTAL TO COMPRESSION

HN Mayrovitz, N Sims, College of Medical Sciences, Nova Southeastern University, Fort Lauderdale, FL

INTRODUCTION

Compression bandaging is the main treatment for lower extremity venous ulcers and is effective for treating peripheral edema and lymphedema. Current concepts indicate that compression effectiveness for venous ulcers is in part linked to the amount of pressure it exerts and clinical practice is in part based on the fact that higher compression levels yield a more favorable outcome on venous ulcers. As a consequence, sustained sub-bandage pressures of 40 mmHg are selectively advocated. Because external compression also affects blood circulation, it is important to consider the quantitative effects it has on tissue that is compressed and also in tissue distal to the compression region. Previous work showed that foot-to-knee compression bandaging of legs of healthy persons, at an average sub-bandage pressure of 27 mmHg, caused significant reductions of skin blood perfusion (SBF) at the sites distal to compression, but had little detectable effect on blood flow under the bandage, in skin overlying softer tissue in the calf. However, in that study, effects of higher compression pressures were not addressed. An additional clinically relevant question not previously investigated is if the negligible effect of compression on SBF overlying softer tissue can be reliably extrapolated to sub-bandage SBF effects within harder tissue. To answer these questions, we measured changes in SBF overlying the tibia during graded leg compression of 0-40 mmHg and on SBF on foot dorsum skin that was distal to the compression bandage SBF effects within harder tissue. To

METHODS

Subjects: Twelve healthy female subjects (25.5 ± 3.1 years) were randomly selected from a pool of 100 medical school students. No subject had diabetes, a history of peripheral vascular disease, or was taking any vasoactive medication. To help verify normality of lower extremity arterial circulation, ankle-brachial systolic pressure indices (ABI) were determined in all subjects as normal (1.06 ± 0.01). Blood pressures were within the normal range (104 ± 4/69 ± 7).

Initial Procedures: Subjects were studied in a supine position. One laser-Doppler probe was placed overlying a 1/4th portion of the tibia at a standardized position and the other was placed on the distal foot dorsum between the great and second toes. A gel probe to be displaced inward and may sample from a deeper depth that generally has a greater perfusion level. This is not the case for probe placement on skin overlying the tibia which should register perfusion reductions have not been previously reported in all studies may be due to the fact that previous measures were on relatively softer tissue in calf and gaiter areas. In these areas, compression causes the laser-Doppler probe to be displaced inward and may sample from a deeper depth that generally has a greater perfusion level. This is not the case for probe placement on skin overlying the tibia which should register perfusion effects.

RESULTS

Main Findings: The results demonstrate that skin blood perfusion distal to and within a region of leg compression is increasingly compromised in direct relation to the compression pressure employed. The magnitude of the SBF decline is more pronounced distal to the leg compression region than directly under compression site. The absolute magnitude of the SBF reduction at the highest compression pressure used (40 mmHg) was 66.6% at the distal foot dorsum site and 38.6% for the directly compressed tibia site.

DISCUSSION & CONCLUSIONS

The present findings and other related work indicate that lower extremity compression within the range of commonly used therapeutic compression levels, reduces blood flow in the foot and digits by an amount that depends on the magnitude of the compression pressures. The effects within the compressed leg region are less clear and more variable, but the results show a significant graded blood perfusion reduction over the range of 20-40 mmHg. The fact that such local reductions have not been previously reported in all studies may be due to the fact that previous measures were on relatively softer tissue in calf and gaiter areas. In these areas, compression causes the laser-Doppler probe to be displaced inward and may sample from a deeper depth that generally has a greater perfusion level. This is not the case for probe placement on skin overlying the tibia which should register perfusion effects.

REFERENCES