

Femoral Vein Blood Flow Velocities

Nabeel Kouka, MD, MBA ()*; *Len Nass, PhD (**)*; *William Feist, PhD (***)*

INTRODUCTION

An important mechanism for the prevention of deep vein thrombosis (DVT) is the augmentation of venous blood flow in the lower extremities. Various studies indicate that both knee-high (calf) and thigh-high compression garments reduce the incidence of DVT; there is no clear indication as to which type should be used on patients.

External Pneumatic Compression (EPC) devices which consist of garments, which can be called sleeves, are manufactured from a combination of foam/fabric or plastic with non-woven liners or a combination thereof. The garments are designed to be wrapped around the lower extremity and secured with Velcro®. Depending upon the style chosen, a garment can be a calf or thigh length. The garment(s) are then connected to a pump that inflates and deflates bladders contained within the garment. Cycle times vary from manufacturer to manufacturer. Typically, the inflation cycle is 10-15 seconds with a 45-50 second “rest” before inflation resumes. The pumps run continuously and some inflate the left and right extremity simultaneously, while others cycle between the left and right leg.

External Pneumatic Compression of the lower extremity decreases venous stasis by increasing venous return through the deep veins of the legs. This augmentation of the venous blood flow is regarded as an important therapy for the prevention of (DVT).ⁱ The therapy enhances blood flow clearance from the soleal sinuses, valve sinuses and axial veins. Studies have reported the femoral vein blood flow velocity that calf-high devices provide significantly greater peak velocity flow augmentation than thigh-high devices.ⁱⁱ

To evaluate the augmentation of a new product, **VasoPress®**, Several different types of EPC devices were compared to the **VasoPress®** to determine if there were any significant differences

between calf, foot and/or thigh compression blood flow velocities.

THE STUDY

A duplex ultrasound-imaging scan by Sony was used to measure femoral venous blood flow. A male volunteer with no history of DVT, hypertension, diabetes, stroke, and vascular or cardiac pathologies was recruited for the study. EPC products used for the study were **VasoPress** by Compression Therapy Concepts, **Flowtron** DVT by Huntleigh Healthcare, **ALP** by Currie Medical and **SCD** by Kendall.

SUBJECT SELECTION

A normal adult subject, fulfilling the criteria listed below, was recruited to the study.

Age: Over 40 years Old

No History of DVT, Hypertension, Diabetes, Stroke, Vascular or Cardiac Pathologies

OBJECTIVE

To determine the femoral vein velocities in normal subjects using four types of External Pneumatic Compression Systems (EPC).

CONDITIONS

The studies were conducted at ambient conditions of room temperature and humidity. This data was recorded on the case report form for the subject.

PROCEDURE

The Femoral Vein Blood Velocity (FVBV) of one of lower limbs of the subject was measured non-invasively, using a Duplex ultrasonic velocity measurement system. The measurements were made according to the

procedure that follows. The results were entered into a case report form. Measurements were made on the limb with and without the EPC device. The entire set of measurements for one subject was made in one continuous session.

DETAILED PROCEDURE

- Have the examined subject lie supine with legs horizontal.
- Measure the FVBV on the chosen limb before placing the first EPC on the subject.
- Place the first EPC on the subject following specific instructions below.

CLINICAL PROCEDURE

Step:

1. Measure the FVBV on the leg before initiating the first cycle, keep the velocity detector in place and record the next sequence of events.
2. First Cycle (continuous Measurement of FVBV):
 - a. Allow the product to achieve and maintain pressure beneath the garment/sleeve of 40 mmHg during the pressure phase.
 - b. Allow the product to decompress.
3. Repeat step (2) for 10 cycles with first product while continuously measuring the FVBV.
4. Remove the first product and measure the FVBV immediately following removal.
5. Allow the subject to rest for 5 minutes.
6. Measure the FVBV at this time, and proceed to the next step if the velocity has returned to the baseline level measured in step (1).
7. Repeat steps (1) through (6) for the second, third and fourth products, using appropriate set-up procedures.

METHODS OF EVALUATION

The FVBV measurements were recorded on the case report form. Following tabulation and calculations the data was subjected to appropriate

analyses to assess the difference in results obtained between the products.

EQUIPMENT

Duplex ultrasonic scanner with Doppler.
Manufacturer: Sony Model: Acuson 128xp
Serial Number: 0271

CASE REPORT FORM

The case report form was used to record the subject information, conditions of study, date/time of study, and FVBV measurements.

RECORD RETENTION

All originals of case reports, charts, data forms, computer tabulations and statistical analyses will be maintained in the files of Compression Therapy Concepts, Inc.

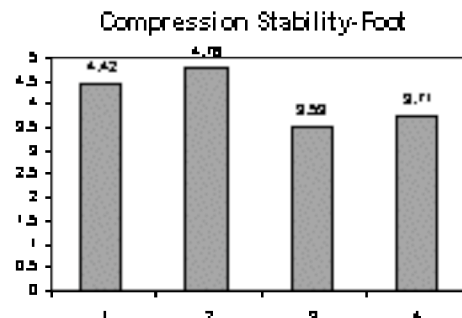
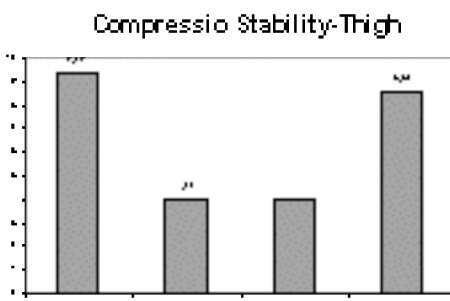
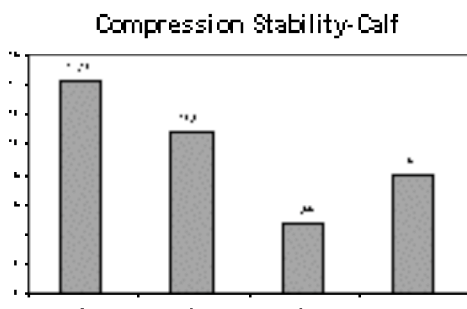
CONCLUSION

The peak velocity augmentation with **VasoPress** was similar or better than the other models tested. This difference was not a non-parametric statistical procedure, which allows a distribution free inference, thus not assuming that the population distribution has any specific form was used in analyzing the findings. A risk of 0.05 was selected for determining statistical significance.

In conclusion, the aforementioned analysis found that the **VasoPress**[®] was more stable and steady in application than the other products evaluated when measured by pressure or variability of pressure. Some products had higher pressure but much more variability. Measuring the peak compression velocity of the products, by relating it to the variability of compression, (Average Compression / Standard Deviation), not only does **VasoPress**[®] show that in all categories the products evaluated are nearly equal to the **VasoPress**[®]; however the **VasoPress**[®] exceeds all the other products, except in one case, where **VasoPress**[®] is equal to the other product. This could be interpreted to mean that **VasoPress**[®] provides more consistent flows given the compression applied.

Results

	Product	Average Augmented Velocity	Base Velocity	Augmented Base	% Aug	Compression Stability	
1	VasoPress Calf VP 501M	56.8	16.4	40.4	246	14.12	Calf
2	Currie Calf ALP 1	66.1	20.3	45.8	226	10.74	
3	Flowtron Calf DVT 10	27.8	7	20.8	297	4.65	
4	Kendall Calf SCD 5329	103.4	16	87.4	546	8	
1	VasoPress Thigh VP 530M	62.6	26.3	36.3	138	9.29	Thigh
2	Currie Thigh ALP 3	68.2	26.7	41.5	155	4.02	
3	Flowtron Thigh DVT 30	67.7	40.3	27.4	68	4	
4	Kendall Thigh SCD 5330	43.9	20.2	23.7	117	8.52	
1	VasoPress Foot VP 520	15.5	3.6	11.9	331	4.42	Foot
2	Currie Foot ALP 11	14	5.3	8.7	164	4.76	
3	Flowtron Foot FG 200	20.2	5.7	14.5	254	3.53	
4	Kendall Foot SCD 5065	21.3	4.9	16.3	333	3.71	



® Compression Therapy Concepts, S. Plainfield, NJ 07080

ⁱ Moser KM: Pulmonary thromboembolism: Your challenge is prevention. J Respiratory Diseases 10:10; 1989

ⁱⁱ Flam E et al: Femoral vein blood velocities with intermittent compression systems: implications for DVT management. Poster Presentation, Feb 24, 1992, American Academy of Orthopedic Surgeons, Washington, D.C.

* Nabeel Kouka, MD, MBA; Medical Director, CTC; S. Plainfield, NJ

** Len Nass, PhD; Associate Professor, New Jersey City University; Jersey City, NJ

*** William Feist, PhD; Professor Emeritus, Monmouth University; W. Long Branch, NJ