

Toe Blood Pressure (TBP) assessments using moorVMS-LDF and moorVMS-PRES

Application note #108

Application

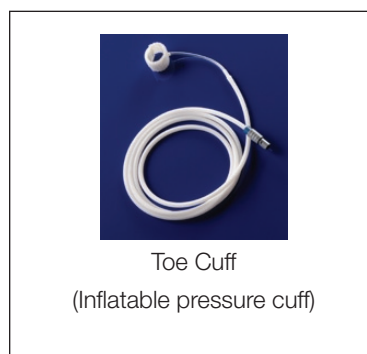
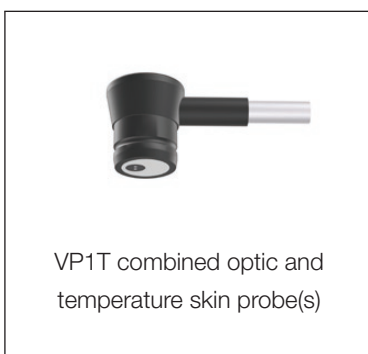
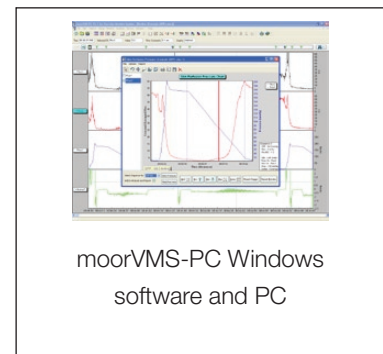
Toe Blood Pressure (TBP) is the measurement of distal limb systolic blood pressure at the toe. TBP is particularly useful in patients with noncompressible tibial arteries, for example those suffering long-standing diabetes, renal failure or other disorders where vascular calcification is present (Clement, TASC II, 2008). TBP can be used in patients with peripheral artery disease (PAD) to assess the severity of ischaemia (Ubbink, 2004) and ultimately lead to early treatment and/or prevention of the formation of ischaemic ulcers in the lower limb.

TBP measurements have been shown to be possible using laser Doppler and automated pressure systems (Wahlberg and Gush, 2002). In a recent publication TBP, using laser Doppler and an automated pressure and analysis package, was shown to have less inter and intraobserver variability than that reported for ABP (Påhlsson et al, 2008).

Routine measurements of TBP can be performed simply and rapidly using the moorVMS-LDF and moorVMS-PRES systems with the default protocol. The user-friendly software enables user defined protocols as required for research – the user is not limited to pre-defined protocols.

Equipment Required

The following equipment is required for TBP assessments: -



*The moorVMS-LDF2 is a new model and replaces previous monitors including the MBF3D, moorLAB server, moorLAB satellite and DRT4. Not necessary if you have another laser Doppler monitor, imager or other flow detection method. The moorVMS-PRES provides you with 2 analogue outputs (pressure and pulse volume) at the rear of the monitor, for use with data acquisition units and chart recorders.

Method

- Refer to the Practical Suggestions Section of this Application Note for environmental and patient recommendations.
- Ensure skin probes are calibrated (See moorVMS-LDF User Guide).
- Measurements should be made with the patient in the supine position – depending upon the size and position of the foot, the toe would be at (or just above) heart level (de Graff et al, 2000)
- Place a pressure cuff around the proximal phalanx of the toe.



- Place skin probes on the toe pulp (usually the great toe), distal to the cuff.
- Set the moorVMS-PC software using the settings shown in Figure 1 – adjust for preferred protocol, see moorVMS-PC user guide for further details or contact your Moor Instruments Representative.

Period	Protocol	Duration (sec)	Pressure/Rate
1	Pre-inflation	10	
2	Inflation		180
3	Hold Time	15	
4	Deflation		2
5	Post-deflation	0	
6			
7	Measure Site		Left Toe
8			
9			
10			
11			
12			
13			
14			
15			

Figure 1 - moorVMS-PC Simple protocol Set-up for Toe Blood Pressure.

Analysis

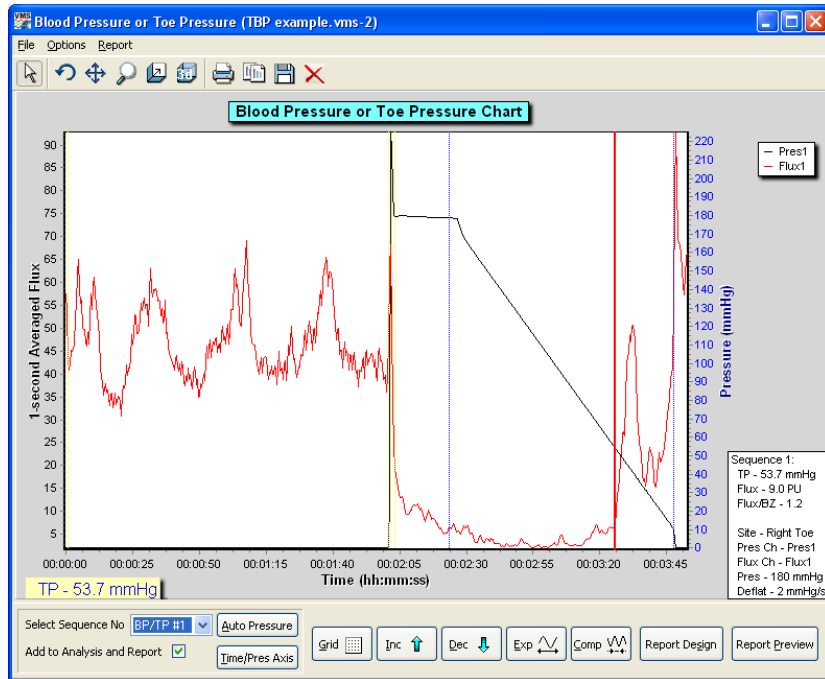


Figure 2 - moorVMS-PC Toe Pressure Analysis Chart.

The TBP report contains the TP chart(s) in addition to the following information:

Sequence Statistics Table:

a) Measurement site (as recorded by the user)

- LBP or TBP - limb blood pressure or toe blood pressure (mmHg)
- Flux - at point of toe pressure measurement (PU)
- Flux / BZ - ratio of flux at toe pressure detection point / biological zero
- Time - timepoint at which TBP is calculated (hh:m:ss)
- Deflation - deflation rate (mmHg/s)
- Flux channel - required if more than one probe is attached
- Pressure channel - required if multiple pressure systems are used
- Average - running average - smoothing to reduce noise
- Pressure calculation - toe blood pressure calculation

b) Site mean Pressure Statistics table following multiple assessments of TBP (or limb pressure)

- Site - as recorded by the user
- Mean TBP - or LBP (mmHg)

c) The pressure detection point can be selected by the User in the Report Design section from the following options:

- 1.2 x Biological zero (i.e. LD 1.2 x flux measured during occlusion)
- 1.5 x Biological zero (default setting)
- 2.0 x Biological zero
- 2.5 x Biological zero
- 5.0 x Biological zero

You can also measure LBP or TBP manually by moving the red line on the analysis chart (figure 2).

Practical Suggestions

Microvascular blood flow can be affected by many things. The following practical suggestions are provided as a guide and are not exhaustive:

- Perform measurements in a quiet room whilst maintaining a comfortable temperature (typically 22°C). Ensure the patient is acclimatised to the room temperature for 30 minutes prior to the measurements.
- Patients should avoid caffeine, alcohol, vigorous exercise, heavy meals and smoking for at least 2 hours prior to the measurements.
- During all measurements ask the patient to breathe normally. Coughing, talking and yawning can all affect microvascular blood flow readings.
- The patient should be in a comfortable, relaxed position and avoid movement during all measurements.
- Cover the feet/legs with a blanket to avoid cooling during acclimatisation and during measurements.

Publications

1. Clement D. 2008 Diagnosis and evaluation of peripheral artery disease – non invasive vascular laboratory and imaging techniques. Based on the Inter-Society Consensus. www.tasc-2-pad.org
2. de Graff J. C., Ubbink D. T., Legemate D. A., de Haan R. J., Jacobs H. M. 2000 The usefulness of a laser Doppler in the measurement of toe blood pressures. *Journal of Vascular Surgery* 32 (6), pp1172-1178
3. Pålsson H. I., Lund, K., Jörneskog G., Gush R., Wahlberg E. 2008 The validity and reliability of automated and manually measured toe blood pressure in ischemic legs of diabetic patients. *European journal of Endovascular Surgery*, 36, pp 576-581
4. Ubbink, D, Th. 2004 Toe blood pressure measurements in patients suspected of leg ischaemia: A new laser Doppler device compared with photoplethysmography. *European Journal of Endovascular Surgery*, 27, pp 629-634
5. Wahlberg E., Gush R. 2002 A new automated toe blood pressure monitor for assessment of limb ischemia. *European Journal of Endovascular Surgery*, 24, pp 304-308

Further Reading

moorVMS-LDF, moorVMS-PRES and moorVMS-PC user manuals for instrument operation and cleaning and handling of optic probes.

www.moor.co.uk - information about moorVMS-LDF, moorVMS-PRES, optic probes and pressure cuffs.

Please feel free to consult sales@moor.co.uk for further advice or support with issues not covered in this application note and details of other application notes using the moorVMS-PRES.

Important Disclaimer: This information is provided to further clinical research into diagnostic capabilities of laser Doppler. The moorVMS-LDF and moorVMS-PRES are CE marked for human use but not specifically for clinical diagnosis of TBP assessments. Calibrated equipment with a current service record should only be used.



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