Effect of subcutaneous pressure on interface pressure measurement in an in-vitro experiment

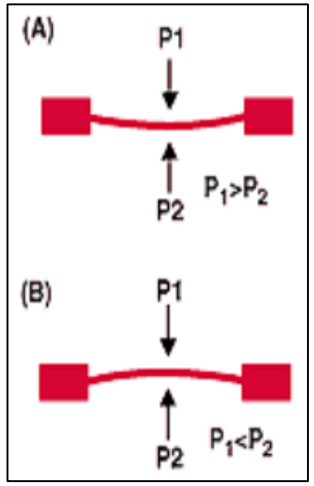
Yung-Wei Chi D.O.
Professor of Medicine
University of California, Davis
Vascular Center

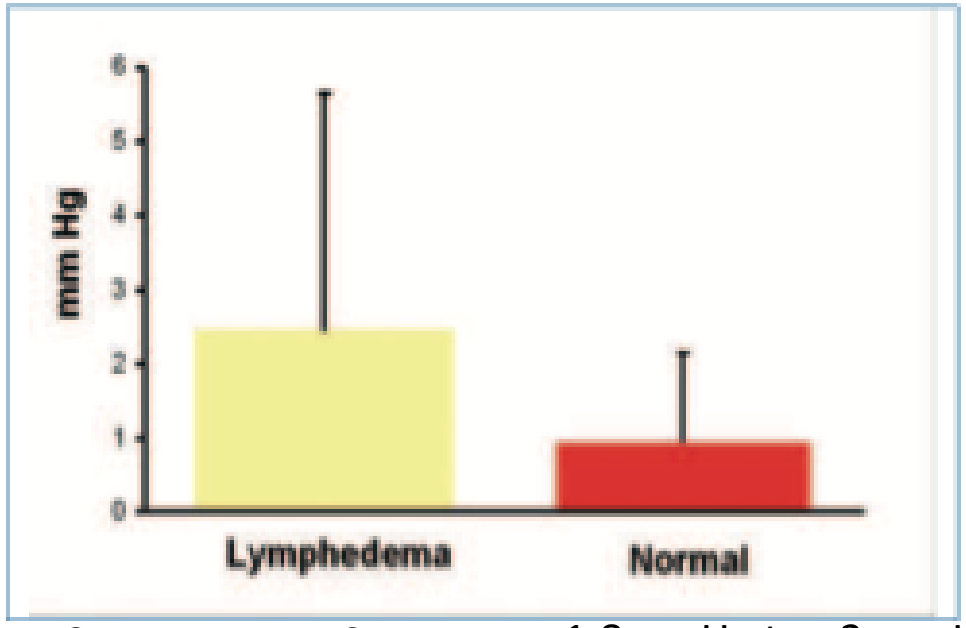
Disclosure

- None

Introduction

- Interface pressure is defined as the pressure that occurs at the interface between the body and the support surface





-3 mmHg to +10 mmHg -1.8mmHg to +3 mmHg

Phlebolymphology. 2010;17(3):144-150.

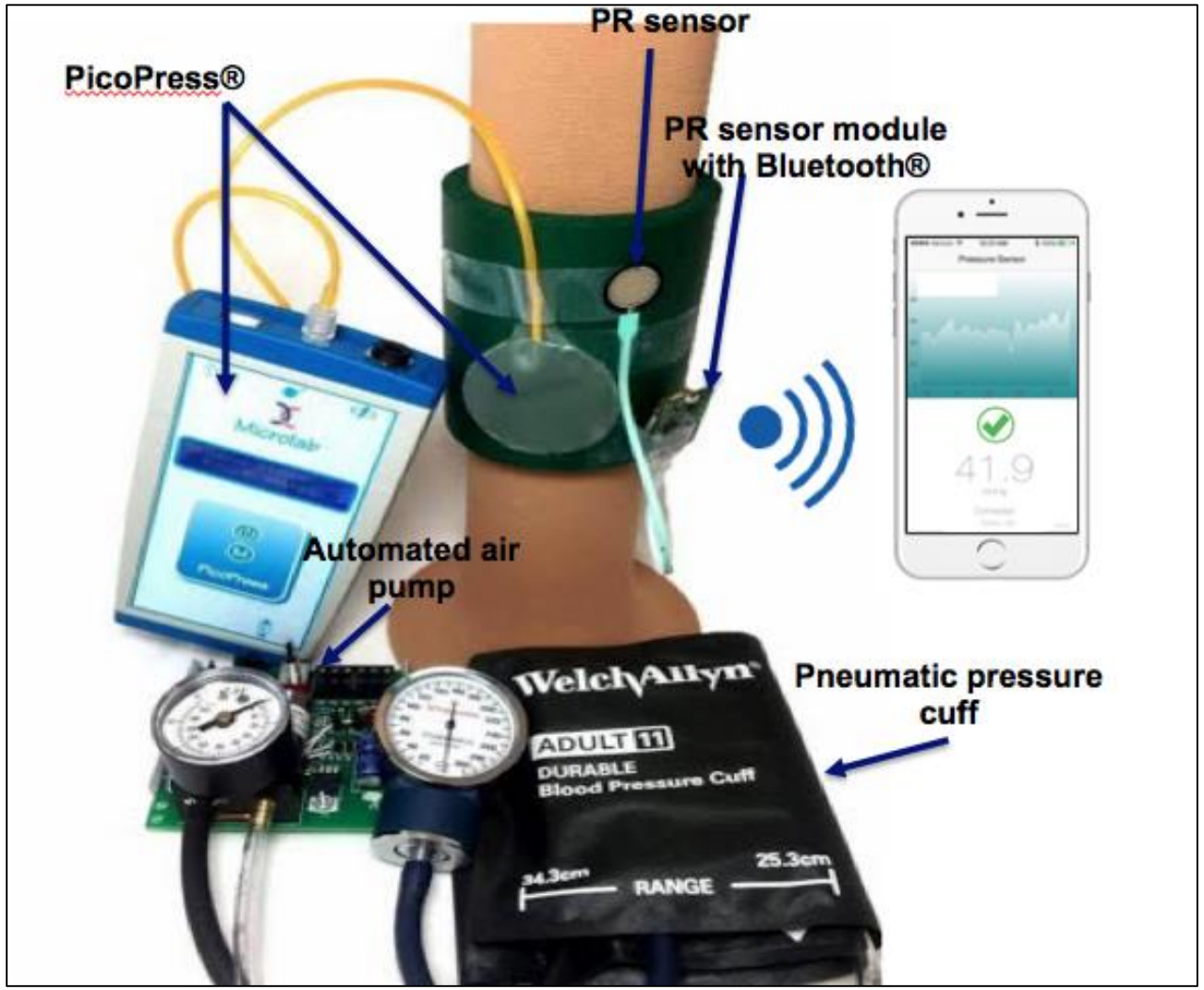
Introduction

- We hypothesize subcutaneous pressure variation affects overall interface pressure measurement.

Method

- BISCO® (Rogers Co, Rogers, CT) BF-2000 silicone foam mimicking normal lower extremity tissue plane was placed on a cylinder cuff model for the experiment: density 160 kg/m3; compression force deflection 10.3 kPa; tensile strength 172 kPa
- Picopress® (Microlab, Padua, Italy) and a piezoresistive sensor were used for interface pressure measurement
- External pressure was applied using an automated pressure cuff at 40 mmHg
- 3 sample measurements were taken per pressure value. Interface pressure recordings were compared between the true pressure, 40 mmHg
- Linear mixed effect model (SAS software, version 9.4, SAS Institute, Cary NC)

Method


PR sensor
PicoPress®
PR sensor module with Bluetooth®
Automated air pump
Pneumatic pressure cuff
Welch Allyn
ADULT 11
DURABLE
Blood Pressure Cuff
34.3cm
RANGE
25.3cm
41.9

Result

Table 1: Summary of interface pressure measurement by piezoresistive sensor and Picopress®

Piezoresistive Sensor				
Subcutaneous Pressure (mmHg)	Interface Pressure (mmHg)	Mean Reading (95% CI)	Difference Between Mean Reading and True Interface Pressure (mmHg)	Percent (%) Difference Between Mean Reading and True Interface Pressure
3	40	42 (39.3, 44.7)	2	5
4	40	42.1 (39.5,44.8)	2.1	5
5	40	42.3 (39.6,44.9)	2.3	6
6	40	42.4 (39.8,45.1)	2.4	6
7	40	42.6 (39.9,45.2)	2.6	6
8	40	42.7 (40.1,45.4)	2.7	7
9	40	42.9 (40.2,45.5)	2.9	7
10	40	43 (40.4, 45.7)	3	8
11	40	43.2 (40.5,45.8)	3.2	8
12	40	43.3 (40.7, 46)	3.3	8
Picopress®				
Subcutaneous Pressure (mmHg)	Interface Pressure (mmHg)	Mean Reading (95% CI)	Difference Between Mean Reading and True Interface Pressure (mmHg)	Percent (%) Difference Between Mean Reading and True Interface Pressure
3	40	45.5 (45.1,45.8)	5.5	14
4	40	45.4 (45.1,45.7)	5.4	14
5	40	45.4 (45.2,45.7)	5.4	14
6	40	45.4 (45.2,45.6)	5.4	14
7	40	45.4 (45.2,45.6)	5.4	14
8	40	45.4 (45.2,45.6)	5.4	14
9	40	45.3 (45.2,45.5)	5.3	13
10	40	45.3 (45.1,45.6)	5.3	13
11	40	45.3 (45, 45.6)	5.3	13
12	40	45.3 (45, 45.6)	5.3	13

Result

- The piezoresistive sensor: different interface pressure measurements under various subcutaneous pressures (mean 42.65±2.7) ($P<0.001$) (Table 1)
  - Difference appeared to be linearly related: as subcutaneous tissue pressure increased, the interface pressure measurement increased

- Picopress®: did not differ between the different subcutaneous pressures (mean 45.4±0.4) ($P=0.54$) (Table 1)

Conclusion

- Subcutaneous pressure affects interface pressure measurement

- Sensor characterization differences may contribute to variation in interface pressure measurement
  - Piezoresistive sensor: interface pressure increased as subcutaneous pressure increased
  - Picopress®: no change in interface pressure with change in subcutaneous pressure