A MODIFIED APPROACH TO F-SCAN POINT CALIBRATION METHOD

[1] Hazliana Hamzah, [1] Noor Azuan Abu Osman
[1]Center for Applied Biomechanics, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur
email: hazliana@um.edu.my

INTRODUCTION

The F-Scan sensor system has been widely used both in the clinical and biomechanical studies due to its dynamic response towards pressure loading.[1] Plantar pressure distribution is especially useful in the treatment of patients with various foot problems.[2] Though highly successful in the clinical setting, F-Scan still attracts less positive feedbacks from researchers due to its over-simplification of the calibration procedure.[2,5-7] This study reports the preliminary assessment of the F-Scan Insole system using a modified calibration setup as compared to the manufacturer suggested calibration.

METHODS

Data were collected in a series of three trials using four insole sensors which were put to tests using calibration method suggested by the manufacturer and a modified calibration method. Equilibration step by using a gage pressure of 100 kPa was done prior to the calibration step to even out the pressure followed by point calibration where the subject stood on the foot to be offloaded and quickly shifted her weight onto the foot to be calibrated. An additional test was done on each sensor for 60s where the pre-analysis of the sensor was carried out using the calibration bladder. Post-analysis data was taken after a gait experiment with the same compressive load as applied during the pre-analysis. The whole experiment was repeated with a modified calibration scheme by using the calibration bladder to generate the calibration fit. The gage pressure applied on the calibration bladder mimicked the pressure applied by the weight of the subject. Pre-analysis, a mock-up gait analysis experiment and post-analysis of the sensor were carried out as before.

RESULTS AND DISCUSSION

The overall pressure data from manufacturer's calibration setting tend is higher compared to the modified calibration in Fig 1. Pressure on the metatarsal area rose almost 50% which differs from the pressure on the metatarsal area for modified calibration that shows an increase within the range of 25% from pressure in heel area. The moment of instability experienced when shifting body weight during manufacturer's calibration might contribute towards the large difference in the reading of pressure between metatarsal and heel areas. The software needed to account for the variability of the applied pressure during balancing on one foot, thus creating a much higher saturation pressure for the generated calibration fit. Table 1 shows a smaller number of loaded cells detected by the sensor during manufacturer's calibration as compared to modified setting.

Since the same sensor was used throughout the experiment, we predicted the performance of the sensor would deteriorate in a stable manner. However, the performance of the sensor was inconsistent for both metatarsal and heel areas in Fig. 1. These inconsistencies may be attributed to the irregularities of pressure data during the calibration process.

	Manufacturer's Calibration			Modified Calibration		
	I	II	III	I	II	III
Force (N)	600	600	600	600	600	600
Raw Sum	4279	4681	4203	6308	5626	4530
No. of loaded cells	304	335	323	640	640	639
Saturation Pressure (kPa)	1385.6	1266.6	1410.6	939.9	1053.8	1308.8
Cell Area (cm^2)	0.2581	0.2581	0.2581	0.2581	0.2581	0.2581
Calibrated Pressure (kPa)	206	206	206	206	206	206

Table 1: Comparison of calibration data

CONCLUSION

F-Scan Insole Sensor is a great sensor only when its performance is carefully monitored. This modified approach may be used to increase the accuracy of F-Scan data.

REFERENCES

1. Luo ZP, et al. *J Rehabil Res Dev.* **35**(2):186-191, 1998.
2. Nicolopoulos CS, et al. *The Foot.* **10**:124-130, 2000.
3. Orlin MN, et al. *Phys Ther.* **80**(4): 399-409, 2000.
4. Park ES, et al. *Arch Phys Med Rehabil.* **87**(5):703-709, 2006.
5. Randolph AL, et al. *Phys Med Rehabil.* **81**(5):573-578, 2000.
6. Hsiao H, et al. *Ergonomics.* **45**(8):537-555, 2000.
7. Woodburn J, et al. *Clin Biomech*. **11**(5):301-304, 1996.

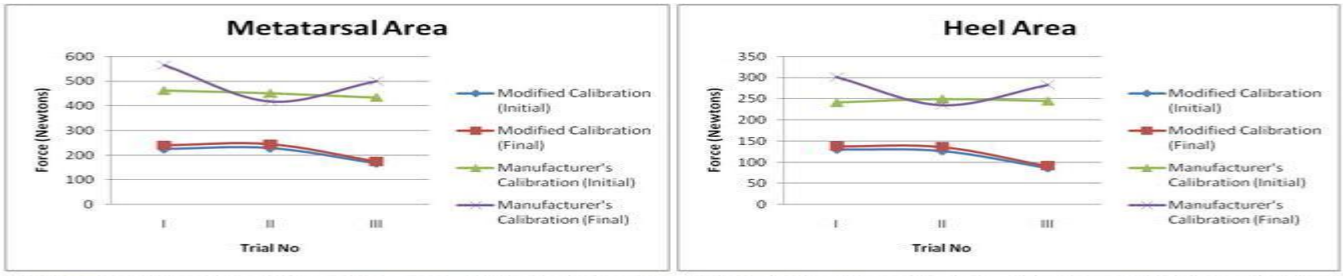

Figure 1: Comparison between F-Scan point calibration and modified calibration settings for force data.