A STUDY OF DYNAMIC PEAK FORCE AND CENTRE OF PRESSURE (COP) DISPLACEMENT, IN SUBJECTS WITH FIRST METATARSAL PAIN

Elaine Yule[1,2], Nachiappan Chockalingam[1]
[1]Faculty of Health and Sciences, Staffordshire University, Stoke-on-Trent, UK
[2]Glasgow Primary Care NHS Trust, Glasgow, UK

INTRODUCTION

Diverse opinion surrounds the subject of orthoses management of pain across a wide range of professions. With the current trend of evidence-based management, there is a clear need to consolidate and investigate these varying opinions. Subjects with pain in the first metatarsal area, referred from a wide team of clinicians were recruited to take part in this study. By employing the approach suggested by Fuller (2000) this investigation examined whether the dynamic peak forces were applied to the reported areas of pain. Furthermore, this study investigated if the addition of lateral forefoot wedging would deviate the Centre of Pressure (CoP) laterally, thus offloading the medial column.

All subjects meeting the following inclusion criteria were invited to take part in the study. (1) first metatarsal pain (Bosjen-Moller, 1978); (2) no diagnosed arthritis (Glasoe,1999); (3) no current orthoses management; (4) maximum eversion height $\geq$ 3mm (Fuller, 2000); (5) presence of late mid stance pronation (Kirby, 1989; Fuller (2000); (6) average to laterally deviated sub talar joint axis (Fuller, 2000); (7) aged between 18 and 45 years old.

METHODOLOGY

A pressure platform (RS Scan, Belgium) was employed to collect the kinetic data. After appropriate ethical approvals both from the University and from the Health Authority, Thirteen subjects with reported first metatarsal pain, 11 female mean age 39 (range 24-45) and 2 males mean age 40 (range 34-45), were included in the trials. Each subject was used as their own control before and after the intervention.

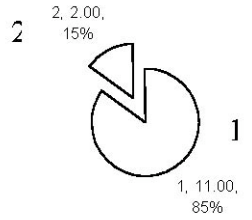
The pressure plate was placed in the centre of a walkway and the subjects were allowed to walk across the walkway and accustom themselves to the lab environment before any data collection. Data from five trials in each condition, which included barefoot, shod and shod plus lateral forefoot wedging, were collected. All necessary time domain parameters were recorded and Wilcoxon signed rank test was used for statistical analysis.

RESULTS AND DISCUSSION

As indicated in Figure 1, results showed that the majority of subjects with pain in the first metatarsal did not have their peak forces in this area. Moreover, with the addition of lateral forefoot wedging, the CoP deviated laterally in 69% of cases and medially in 31% (-2.89 +/- 4.3mm; $p=0.030$ as shown in Figure 2).

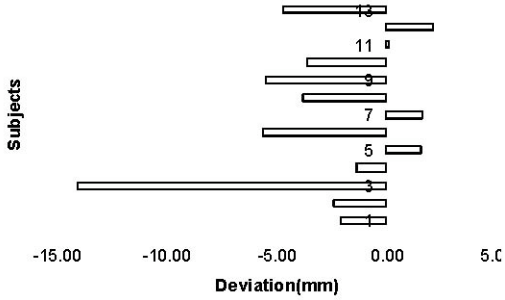
The results highlight that it would be unwise to assume that the location of peak forces and movement of centre of pressure lines could only have one meaning or value. Furthermore, pressure analysis needs to be looked at in conjunction with other clinical measures and is not a substitute for clinical assessment and observation.

Figure 1: Location of Peak Force



1 - Subjects with lateral forefoot peak force.
2 - Subjects with medial forefoot peak force

Figure 2: CoP deviation



Movement of the CoP line. (mm)

REFERENCES

(1) Bojsen-Moller, F. (1979) Calcaneocuboid joint and stability of the longitudinal arch of the foot at high and low gear push off. *Journal of Anatomy,* **129**:165-176.

(2) Fuller E.A. (2000) Reinventing biomechanics. *Podiatry Today*. 12/2000: 3.

(3) Glasoe, W.M., Yack, H.J, and C.L. Saltzman, (1999) Anatomy and biomechanics of the first Ray. *Physical Therapy*. **79**: 3.

(4) Kirby, K. (1989) Rotational equilibrium across the subtalar joint axis. *Journal of the American Podiatric Medical Association*. **79**: 1-14.