INTRODUCTION

Repetitive mechanical loading has been associated with lower limb joint pain (Radin et al., 1991). The joint contact forces that arise from mechanical loading are due to a combination of reaction forces and muscle forces. During running, ground reaction forces can be reduced by shortening stride length (Mercer et al., 2005). It is unclear if shortening stride length has similar effects on joint contact forces.

The purpose of this study was to determine if reducing stride length decreased joint contact forces and joint contact loading rates during running.

METHODS

Five experienced male runners participated in this study (age: 21.6 ± 3.3 yrs, height: 176.5 ± 2.9 cm, mass: 68.5 ± 4.6 kg). Kinematic and kinetic data were collected while subjects ran at their preferred stride length (PSL) and -10% their preferred stride length (-10%PSL). Subjects performed ten trials at each condition. Stride length was adjusted by having the subjects strike targets placed on the floor. A trial was considered successful if the subject consistently hit the targets and was within ± 5% their preferred running velocity. The average preferred running velocity was 4.2 ± 0.3 m/s.

Three dimensional kinematics of the thigh, leg, and foot were calculated using a flex/ext, abd/add, introt/extrot sequence.
each subject and effect sizes between conditions were calculated. We used Cohen’s (1992) suggestion that effect sizes of .20 are small, .50 are medium, and .80 are large. Only variables with medium effect sizes, or better, are reported below.

RESULTS AND DISCUSSION

Axial joint contact forces were similar to those previously reported for running (Glitsch & Baumann, 1997). While axial forces were always compressive, the direction of AP and ML shear forces were dependent upon the joint and percentage of stance (Figure 1). Peak axial loading rates always occurred during the impact phase of stance between 0 and 30%. The occurrence of peak shear loading rate varied.

Medium effects were observed for ML hip force (-0.64), ML ankle force (-0.56), and ML ankle loading rate (-0.61). Large effects were observed for axial hip loading rate (-1.07), ML hip loading rate (-1.33), and axial knee loading rate (-0.82). For each variable the effect size was negative indicating a lower value during -10%PSL.

SUMMARY/CONCLUSIONS

These findings suggest that decreasing stride length may be an effective way to minimize repetitive mechanical loading that occurs during running. Future research will look to increase sample size to see if these trends are statistically significant.

REFERENCES


Figure 1: Ensemble average axial and shear joint contact forces at the hip, knee, and ankle for one subject. Solid line = PSL; Dashed line = -10%PSL; +AP = anterior shear; +Axial = tension; +ML = lateral shear.