quadriceps magnitudes and temporal patterns were influenced by disease presence and severity. Activation imbalances between the lateral:medial gastrocnemius and hamstrings were found with greater radiographic severity ($p < 0.05$).

Conclusions: Despite similarities in walking velocity, age and WOMAC scores, these findings show that characteristics of periarticular muscle activity are altered in a progressive manner with knee structural severity illustrating an association between joint structure and function. These results have implications for understanding the OA disease process and associated functional deficits.

170
GENDER DIFFERENCES IN KNEE JOINT LOADS WITH INCREASING BODY MASS

J. Aaboe, H. Bliddal, R. Christensen, M. Henriksen. *The Parker Inst., Frederiksberg, Denmark*

Purpose: The incidence of knee OA is higher among females than males – an observation that at large remains unexplained. Knee joint loadings are thought to be of particular importance in the pathogenesis of knee OA and correspondingly, obesity and overweight increase the risk of knee OA development. One possible explanation for the higher incidence of female knee OA could be that females fail to adapt their knee joint loads with increasing body mass. The purpose of this study was to investigate the changes in knee joint compression forces with experimental weight gain in healthy lean females compared to healthy lean males.

Methods: In 15 healthy lean females and 15 healthy lean males knee joint compression forces were evaluated by three dimensional gait analyses and subsequent biomechanical modeling. Bare footed gait analyses were performed at self-selected walking speeds with and without body mass modulations. Body mass modulations were accomplished by means of a weight vest adding first 2.5 and later 5.0 BMI points to the subjects. The extra mass was distributed with 60% on the front and 40% on the back of the subjects. Bivariate ANOVA procedures and spearman correlations were used to evaluate whether gender influences changes in knee loads with increasing body mass.

Results: When walking with 2.5 extra BMI points the females increased the knee compression force by 198.7 N (95% CI 120.7 to 276.7) and the males increased the knee compression force by 209.4 N (95% CI 78.8 to 339.9). The gender difference in the increase was not statistically significant ($P = 0.88$). When adding additional 2.5 extra BMI points (for a total of 5 BMI points added) the females increased the knee compression force by an additional 158.8 N (95% CI 90.3 to 227.4), whereas the males increased the knee compression force by an extra 29.8 N (95% CI −193.3 to 252.9). The gender difference in the additional increase was not statistically significant ($P = 0.25$). There were no differences in walking speed across genders and body mass conditions ($P = 0.97$). When adding 2.5 BMI points the magnitude of the extra body mass was positively correlated with the increase in knee joint compression force in females ($r = 0.51$, $P = 0.05$, Figure 1) but not in males ($r = 0.24$, $P = 0.38$, Figure 1). When adding 5 BMI points the magnitude of the extra body mass was positively correlated with the increase in knee joint compression force in females ($r = 0.63$, $P = 0.01$, Figure 2) but not in males ($r = 0.19$, $P = 0.51$, Figure 2).

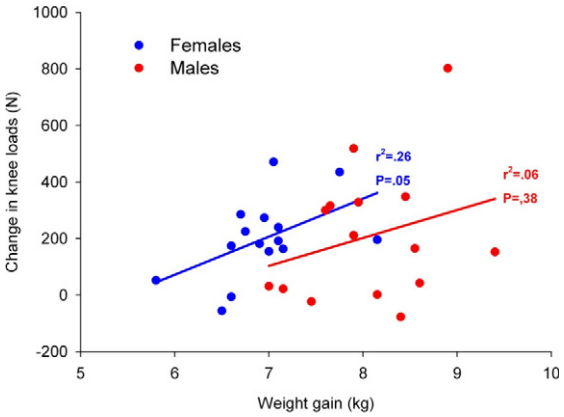

Fig. 1. Effects of experimental weight gain, corresponding to 2.5 kg/m^2, on knee compressive forces in 15 healthy lean females (blue) and 15 healthy lean males (red) with Spearman correlation coefficients (r^2). Level of significance $p < 0.05$.

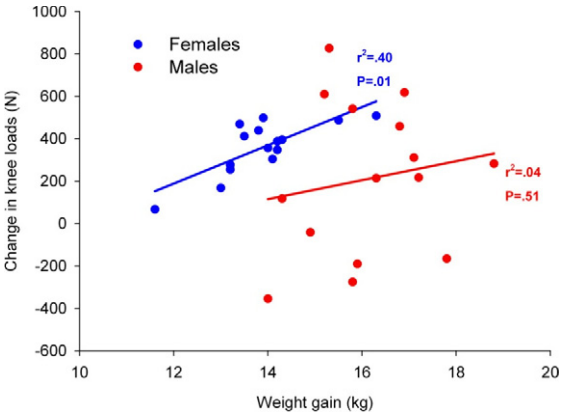

Fig. 2. Effects of experimental weight gain, corresponding to 5.0 kg/m^2, on knee compressive forces in 15 healthy lean females (blue) and 15 healthy lean males (red) with Spearman correlation coefficients (r^2). Level of significance $p < 0.05$.

Conclusions: These data suggest that among females the knee joint compressive forces are coupled with increases in body mass, whereas the males manage to adapt their walking pattern to the extra body mass without a direct increase in joint loads – particularly at higher body mass increases. In the light of the relationship between obesity and knee OA development and the overrepresentation of females among knee OA patients, these data suggest that the higher female knee OA incidence may be due to neuromechanical gender differences in the adaptations to increased body mass. The adaptations in movement patterns with body mass changes are possible targets for future research.

171
DIFFERENCES IN TIBIAL ROTATION DURING WALKING IN PATIENTS WITH ANTERIOR CRUCIATE LIGAMENT DEFICIENCY AND KNEE OSTEOARTHRITIS

R. Moyer, T. Birmingham, I. Jones, T. Jenkyn, J.R. Giffin. *University of Western Ontario, London, ON, Canada*

Purpose: The aim of the present study was to compare tibial external rotation during the stance phase of walking: 1) in the affected and contra-lateral unaffected limbs of patients with unilateral anterior cruciate ligament (ACL) deficiency and concomitant tibiofemoral knee osteoarthritis (OA), and 2) in subgroups of patients with mild and severe OA.

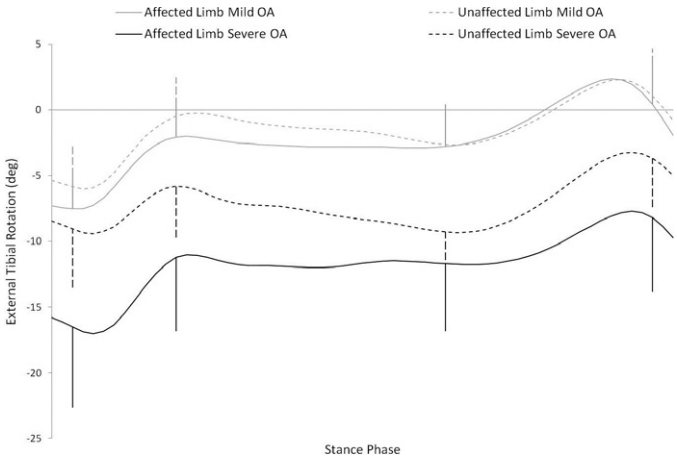

Fig. 1. Difference in internal-external tibial rotation throughout stance between affected limbs (ACL deficient and OA) and contra-lateral unaffected limbs in patients with mild or severe OA. Ensemble average curves represent all patients in each group with 95% confidence limits at four time points during stance: heel strike, mid-stance, terminal extension and toe-off.

Methods: 68 patients with confirmed unilateral ACL deficiency and medial knee OA underwent radiographic assessment and three-dimensional gait analysis with an optical motion capture system.