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Biomechanical Mediators of the Relationship Between the Knee Osteoarthritis Phenotype and Knee Joint Compressive Forces

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Pain, due to increased knee joint compressive forces resulting from increased body weight, is likely the driving factor that alters gait for those with knee osteoarthritis (OA), thus, a need exists to determine what can reduce these forces. OA patients may exhibit a specific phenotype of high fat mass and bone mineral density (BMD) that is associated with increased knee forces and disease progression. Whether this relationship is mediated by biomechanical factors has not been investigated. **PURPOSE:** To investigate the associations between leg BMD, fat mass, and lean mass on knee joint compressive forces in older adults with knee OA, and to determine whether these relationships are mediated by stride length, knee stiffness, and/or leg strength. **METHODS**: Baseline DXA scans, knee extensor strength, and gait data from 75 participants (66.8 $\pm$ 6.7 years) from the Strength Training for Arthritis Trial (START) were analyzed. **RESULTS**: Average BMI was 30.8 $\pm$ 5.4 kg/m^2. DXA characteristics revealed an average leg BMD of 1.24 $\pm$ 0.16 g/cm^2 and a % body fat of 70.7 $\pm$ 7.9. Average stride length was 1.33 $\pm$ 0.12 m, knee stiffness was 4.2 $\pm$ 2.1 Nm/°, leg strength was 74.2 $\pm$ 25.6 N, and knee compressive force was 2117.2 $\pm$ 622.6 N. Leg BMD ($p= 0.006$) and fat mass ($p<0.001$) were positively correlated with knee joint compressive forces. Stride length, average knee stiffness, and leg strength were partial mediators for the relationship between percentage body fat and knee forces. Leg strength was also a partial mediator for the relationship between leg BMD and knee force. **CONCLUSIONS**: The OA phenotype is associated with increased knee joint compressive forces. Reductions in body fat percentage and stride length, or alterations in leg strength and knee joint stiffness can potentially lower knee joint compressive forces, and pain, in older adults with knee OA.

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