

related to high articular cartilage TF T1 ρ - and T2. Peak external extension moment was related to low articular cartilage T1 ρ - and T2 and high T1 ρ - and T2 in 4 of 6 meniscus compartments.

Greater Q:H CSA ratio was related with greater TF T1 ρ ($r = 0.327$) and T2 ($r = 0.401$). Greater M:L Q ratio was associated with greater M:L ratio of meniscus T1 ρ ($r = 0.337$). Greater M:L Q ratio was associated with greater KAM peaks ($r=0.357$) and impulse ($r=0.461$), and greater frontal ROL ($r= 0.303$). Greater Q:H ratio was associated with greater peak frontal ($r= 0.645$) and sagittal moments ($r = 0.360$) and greater dynamic frontal malalignment ($r = 0.330$)

Conclusions: These are the 1st results to show relationships between static/dynamic alignment, muscle balance and cartilage composition in young health subjects. Based on these data, young subjects with varus show worse medio-lateral balance of cartilage composition likely progressing to OA. The impact of static and dynamic loading is more pronounced on the meniscus than the articular cartilage indicating a more important role of meniscus in pathogenesis of knee OA than previously thought. These data also show for the 1st time that muscular imbalance (high Q:H and M:L CSA ratios) is related to high knee loads (high KAM impulse) and worse cartilage composition (high T1 ρ - and T2). Overall, these data suggest the need for development of preventive programs that emphasize muscle retraining and strategies to alter medio-lateral balance of cartilage composition. We continue to process the data to assess relationship of functional mechanics with articular cartilage laminar T1 ρ - and T2 relaxation times and texture values. We are also in the process of doing subregional analysis of articular cartilage in light of the findings of different relationship of flexion and extension moments with T1 ρ - and T2 relaxation times.

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RECOVERY IN HORIZONTAL GAIT AFTER HIP RESURFACING VS. TOTAL HIP ARTHROPLASTY AT 6-MONTH FOLLOW-UP - A RANDOMIZED CLINICAL TRIAL

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Standard total hip arthroplasty (THA) is the established surgical treatment for patients older than 65 years with progressive osteoarthritis. However, implant survivorship curves decline more rapidly in patients younger than 50 years. Resurfacing hip arthroplasty has therefore been suggested as an alternative for younger more active patients. Walking ability is one of the most common and useful outcome measures used in hip replacement patients, and the ability to safely ambulate is considered a pre-requisite for discharge from most orthopedic facilities. Improvements in walking ability and kinematics have been suggested after hip resurfacing, but no study so far has objectively assessed this aspect in a randomized trial including standard THA.

Purpose: To test the hypothesis that (i) a superior recovery in gait would be observed following resurfacing total hip arthroplasty compared to standard total hip arthroplasty and (ii) to investigate the hypothesized relationship between mechanical hip and knee muscle performance and horizontal gait function in patients with total hip replacement.

Methods: Forty-three patients were randomized into either standard or resurfacing THA. Three-dimensional gait data were collected at self-selected normal and maximal walking speed. Primary outcome was gait speed while secondary outcomes comprised selected temporospatial and kinematic parameters obtained during horizontal walking. Explorative outcome was the relationship between isolated mechanical hip and knee muscle performance and horizontal gait function in younger THA patients 56 ± 6 years (range 44–64). Data was collected pre-operatively, 2 and 6 months post-operatively

Results: There was no effect of treatment on horizontal self-selected normal speed, however an effect of treatment was observed on maximal walking speed where standard THA subjects walked faster than the hip resurfacing subjects ($P = 0.03$). No differences in the recovery of spatio-temporal parameters were observed. Also, peak hip flexion and peak hip adduction angles recorded during the stance phase were similar in both

groups. Maximal isometric knee and hip muscle strength were positively associated with gait speed, step length and cadence during maximal walking ($R^2 = 0.13-0.37$, $P < .05$).

Conclusions: The present data could not provide evidence to support the hypothesis that resurfacing total hip arthroplasty should lead to a superior recovery in gait and hip kinematics compared to standard 28-mm hip arthroplasty in younger hip arthritis patients. Maximal isolated leg muscle strength was a predictor of horizontal gait performance, and thus provides an important and valid functional outcome measure for individuals undergoing total hip arthroplasty.

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WALKING WITH INCREASED FOOT PROGRESSION ANGLE CAN REDUCE JOINT COMPRESSION IN INDIVIDUALS WITH KNEE OA

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Purpose: The knee adduction moment is an often used surrogate measure to infer joint contact force. Treatments and/or gait alterations to reduce the magnitude of the moment are sought for those with knee OA, since smaller moments are believed to be associated with less joint compression. Previous work suggests there is little change in peak adduction moment when walking with an increased foot progression angle (FPA). We propose that greater FPA can decrease joint contact for some people, even though it may not reduce the peak adduction moment relative to normal walking. The purpose of this study is to present data in support of this thesis and to suggest that walking with greater FPA may be an effective strategy for reducing joint loading in persons with knee OA.

Methods: Ten subjects (six male, four female) with mild to moderate medial compartment knee OA (KL-grade I-III) were referred by an area orthopaedist. Average subject age was 64 years (± 8), body weight 81.8 kg (± 12.7), height 1.68 m (± 0.08), and body mass index 29.0 (± 5.6). Subjects were pain free at time of testing. A six-camera motion capture system and a force platform were used to compute joint moments and reaction forces at the knee for normal gait and walking with a 15 degree increase in FPA. Subjects performed 5 trials for each condition. Joint moments and reaction forces were normalized by body weight (BW) and height, and BW respectively. Walking speed was monitored using photo-electric timers.

Results: There was no difference in walking speed for the normal and toe-out conditions (1.28 ± 0.23 m/s & 1.26 ± 0.24 m/s). The average toe-out angle during normal walking was 2.0 ± 6.8 degrees and 18.6 ± 8.9 degrees with increased FPA. The average peak adduction moment for all 10 subjects was almost identical for the 2 conditions, while the extensor moment was approximately 5% smaller when walking with increased FPA. Subjects were then grouped into those who had a larger than average decrease in peak extensor moment and those who did not. The knee extensor moment was smaller for 6 of 10 subjects when walking with increased FPA (0.028 vs. 0.024 N-m/(BW*Ht), $p < 0.05$); there was no difference in peak adduction moment (Fig.1).

Conclusions: Peak contact force occurs at approximately 25% of stance, the same time the extension and adduction moments reach their peak. A decrease in peak adduction does not guarantee a reduction in peak contact force if there is a concomitant increase in extensor moment. This has been shown for a patient with an instrumented knee prosthesis while walking with a medial thrust gait. We propose the opposite is also true. That is, reduced joint compression is possible when the extension moment is smaller and the adduction moment does not increase. This pattern was seen for 6 of 10 subjects walking with increased FPA (Fig. 1). The clinical relevance of this work is twofold. Firstly, we suggest that it is important to consider the knee extension moment when inferring changes in joint contact force estimated from the adduction moment. This is not common practice as most studies focus on the adduction moment in isolation. Secondly, walking with a toe-out gait may be an effective strategy to reduce joint compressive forces in some patients with knee OA. Future work will involve predicting joint contact force for subjects walking with increased FPA using an EMG-driven musculoskeletal model.

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