127 GENERALIZED DEFICITS IN VIBRATORY PERCEPTION IN OSTEOARTHRITIS (OA) OF THE LOWER EXTREMITY

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Purpose: Sensory deficits, including proprioception and joint kinesthesia, as well as vibratory loss (*Arthritis Care Res '08*), have been reported in knee OA. The pathophysiologic role of these deficits is unclear; it is possible either that OA-mediated joint destruction leads to these deficits or, conversely, that pre-existing sensory deficits increase the risk for developing knee OA. Here, we compare the vibration perception threshold (VPT) at the upper and lower extremity of subjects with knee OA or hip OA to subjects without OA, to test the hypothesis that lower extremity OA is associated with generalized vibratory deficits in both the upper and lower extremities.

Methods: 67 subjects with knee OA and 14 subjects with hip OA were compared to 22 age-matched control subjects without OA. VPT was assessed using a biothesiometer operating at a frequency of 120 Hz. Five sites at the lower extremity (first metatarsophalangeal joint (mtp), medial malleolus, lateral malleolus, medial femoral condyle, and lateral femoral condyle) were evaluated. In addition, 43 of the knee OA, 12 of the hip OA, and 14 of the normal subjects had VPT evaluated at the radial head. At each site, the biothesiometer was initially set at "0" volts and the voltage output increased by 1 volt/second. The subjects were instructed to comment upon their first sensation of vibration and this voltage was noted as the VPT. VPTs were repeated twice at each site and a mean value recorded. The intraclass correlation coefficient (ICC) between initial and repeat testing on separate days was 0.96 to 0.99. Independent samples t-test was used to compare VPT of OA subjects with normals. Linear regression was used to evaluate the effects of age and body mass index (BMI) on the results; $p < 0.05$ was considered significant.

Results: The mean age (±SD) of the knee OA subjects was 57±11 yrs, hip OA subjects 63±9 yrs, and normal subjects was 57±9 yrs ($p = 0.162$). VPT was significantly increased at all 6 sites, including the radial head, in the OA subjects compared to controls (Table). These results were indepedent of the effects of age and BMI. There were no significant differences at any site between the knee and hip OA groups.

Table. VPT values

	1st MTP	Medial Malleolous	Lateral Malleolous	Medial Femoral Condyle	Lateral Femoral Condyle	Radial Head
Knee OA (VPT±SEM)	15.3±1.2*	19.6±1.3*	19.5±1.2*	24.1±1.2*	24.8±1.2*	10.5±0.7*
Hip OA (VPT±SEM)	14.1±1.2*	17.4±2.5*	18.8±2.4*	20.6±2.3*	25.9±2.5*	9.8±0.7*
Controls (VPT±SEM)	6.7±0.5	11.2±1.1	9.7±0.9	14.6±1.5	18.0±1.8	7.6±0.5

*p < 0.05 compared to normals

Conclusions: This study demonstrates that vibratory sense deficits are present in lower extremity OA, including both knee OA and hip OA. Interestingly, significant vibratory deficits are detectable in the upper extremity in both knee OA and hip OA relative to normals; this suggests that lower extremity OA involves a generalized process affecting distant and clinically uninvolved sites, and is not merely a local degenerative disease. Further study is necessary to characterize this process and to elucidate the relationship of these deficits to other sensory deficits observed in OA, and their collective role in the neuromechanical pathophysiology of lower extremity OA.

128 RELATIONSHIPS BETWEEN KNEE JOINT LOADS AND MOMENTS DURING WALKING FOLLOWING WEIGHT LOSS IN OBESE OSTEARTHRITIS PATIENTS

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Purpose: The role of gait biomechanics, in particular knee joint loads, in knee OA progression is well established. The external knee adduction moment have been shown to be determinate of medial joint loads and disease progression. Consequently, the adduction moment has been used as a proxy for joint loads. Load reduction in the form of weight loss has been proven effective against knee OA, and is recommended as treatment of choise among non-surgical interventions. It is however unknown if weight loss affects the adduction moment magnitude, and if the changes in adduction moments are related to changes in medial compartment joint loads. Accordingly, the purpose of this study was to investigate the effects of weight loss on medial compartment joint loads, knee joint moments during loading response of the gait cycle, and their relationship in obese knee OA patients.

Methods: 16 overweight (BMI > 30) patients with symptomatic knee OA were studied. Three-dimensional gait analyses were done before and after a 16 weeks dietary intervention. The patients were analyzed at their self-selected comfortable walking speeds. Joint moments were calculated using standard inverse dynamics, and medial compartment loads were estimated using a previously published statically determinate knee model.

Results: The mean baseline body weight was 101.4 kg (SD 3.5). After the intervention the mean body weight was 88.0 kg (SD 2.6) and the average weight loss was 13.5 kg (SD 5.3). There were no changes in walking speed. The weight loss significantly reduced the absolute medial compartment loads and joint moments (see table 1). When the data was normalized to body weight, no significant differences were observed.

At baseline and follow-up there were significant correlations between peak medial compartment loads and peak internal extensor moments (baseline: $r = 0.75$, $P < 0.001$; follow-up: $r = 0.86$, $P < 0.0001$). Similar correlations were found between peak medial compartment loads and the peak external adduction moment (baseline: $r = 0.74$, $P < 0.001$; follow-up: $r = 0.82$, $P < 0.0001$).

There was no correlation between changes in medial compartment loads and changes in the external adduction moment ($r = 0.26$, $P = 0.32$, see figure 1). Nor were there correlations between changes in body weight and changes in joint moments (add.: $r = -0.007$, $P = 0.76$; ext.: $r = 0.00$, $P = 1.0$, see figure 2A and 2B). There was a significant correlation between changes in medial compartment loads and changes in the internal extensor moment ($r = 0.83$, $P < 0.0001$, see figure 3).

Conclusions: These data confirm that weight loss significantly reduces knee joint loads during walking, and that peak external adduction moment can be used as a proxy for medial compartment loads in cross-sectional studies. The results also show that medial compartment loads can be assesed using peak internal extensor moments as proxy. However, the main finding is that changes in medial compartment loads following weight loss are closer related to changes in peak extensor moments than in peak adduction moments. While joint loads are reduced following weight loss, the present results may imply that interventions aiming at reducing the adduction moments should be administered as well.

Table 1

	Absolute reduction	P	Normalised reduction (bodyweight normalization)	P
Peak medial compartment loads	505.0 N (SD 103.0)	<0.0001	0.4 N/kg (SD 1.0)	0.70
Peak extensor moment (internal)	22.1 Nm (SD 7.4)	0.007	0.1 Nm/kg (SD 0.1)	0.22
Peak adduction moment (external)	10.5 Nm (SD 1.9)	<0.0001	0.0 Nm/kg (SD 0.0)	0.13

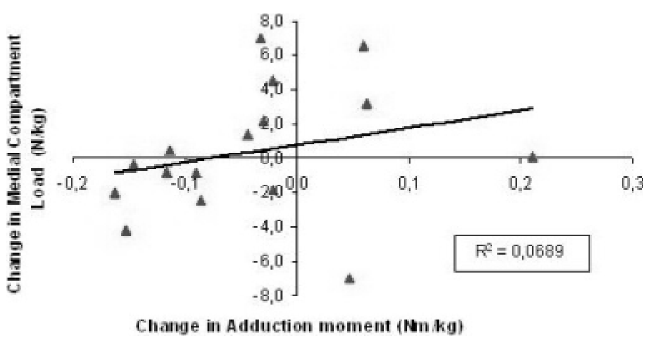

Figure 1.

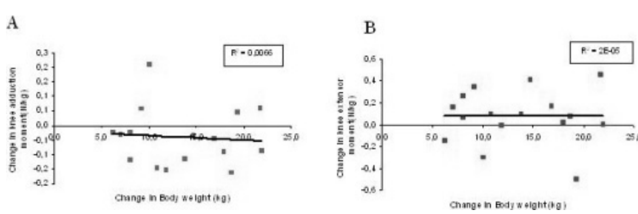

Figure 2.