JOINT LOADING IN HIP OSTEOARTHRITIS PATIENTS OF DIFFERENT RADIOLOGICAL SEVERITY

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Introduction

Patients with hip osteoarthritis (OA) suffer from pain and restriction of hip mobility leading to an altered gait pattern. Specifically, hip OA patients showed changes in the peak joint moments at the affected hip [Foucher, 2012]. Changes in the loading at the knee or ankle joints due to hip OA severity have not been reported so far. The current study therefore examined systematic differences in kinetic gait patterns related to hip OA severity as classified by X-ray images.

Methods

In 55 patients with unilateral hip OA, three dimensional (3D) hip, knee, and ankle joint forces and moments were calculated via inverse dynamics following 3D gait analysis (Vicon Plug-in Gait, barefoot, self-selected walking speed). The patients' disease severity (affected limb) was classified, using the Kellgren/Lawrence (KL) grading scale [Kellgren, 1957], as moderate (M-OA) [KL < 4] or severe (S-OA) [KL > 3] (Table 1).

	Age [yrs]	Body weight [kg]
M-OA (n = 29)	36-69	79 ± 12
S-OA (n = 26)	46-72	80 ± 15

Table 1: Group characteristics: Age (range), body weight (mean ± SD) and number of patients (n).

3D joint kinetics (normalized to a gait cycle and BW) and spatio-temporal variables (gait speed, percentage stance, stride length, and time) were averaged over five walking trials for each patient. The waveforms of the kinetic variables were analyzed using a principal component (PC) analysis [Nüesch, 2012]. The first five PC-scores (> 82.0% cumulative variance) and the spatio-temporal variables were analyzed for severity-related effects. Results with a medium effect size (pooled Cohens' $|d| > 0.5$) combined with significance ($p < .05$) of a Wilcoxon rank sum-test were reported.

Preliminary Results

This study identified one systematic severity-related change (d = 0.94, p = .002) in PC3 (eigenvalue (EV) = 5.5%) calculated for the hip rotation moment (Figure 1). In PC1 (EV = 83.2%) calculated for the internal knee rotation moments, a trend ($|d|$ = 0.53; p = .12) was observed with increased internal knee rotation moments during stance for S-OA. Spatio-temporal variables and the residual loading variables did not vary between groups.
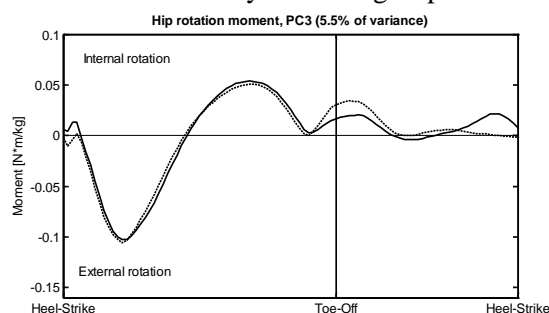

Figure 1: Systematic differences in the hip rotation moments of the M-OA (solid) and S-OA (dashed) groups (mean waveform + weighted PC3-waveform).

Discussion

Our results suggest that hip OA severity indicates the strongest effects (A) for the rotation moments and (B) the affected joint. Compared to M-OA, S-OA walked in a manner with increased and reduced hip loadings around toe-off and terminal swing, respectively. As only systematic differences were found in PC3, the degree to which hip joint loadings in hip OA patients is affected appears to be highly individual and not directly related to OA severity. Thus, hip OA severity seems to cause comparatively small systematic changes in the joint loadings.

References

Foucher et al, J Biomech, 45:1360-1365, 2012.
Kellgren and Lawrence, Ann Rheum Dis, 16:494-502, 1957.
Nüesch et al, Clin Biomech, 27:613-618, 2012.