LOADING DURING STAIR WALKING IN MEN WITH KNEE OSTEOARTHRITIS

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Introduction
The impulsive loading affecting the musculoskeletal system during stair walking can be vigorous [1]. Radin et al. [2] have stated a hypothesis that repetitive impact loading during walking may contribute to progression of the knee osteoarthritis (OA). However, the role of neuromuscular system in protection of an articular cartilage from potentially adverse compressive and shearing forces is not fully understood. The aim of the present study was to compare the loading during stair walking of the knee OA patients to age- and sex-matched healthy controls using skin mounted accelerometers (SMAs) and surface electromyography (sEMG).

Methods
After familiarization, patients with uni- or bilateral knee OA (n=54, aged 49-68 years) and 53 age-matched randomly selected healthy men performed stair descending and ascending trials barefoot at two pre-determined speeds (0.5 and 0.8 m/s +/-5%). The trial order was randomised. During the measurements two tri-axial SMAs, attached just above and below the more symptomatic knee joint, were utilized to assess joint loading. The reproducibility of SMAs in loading measurements has recently been established [3]. The axial initial peak acceleration (IPA) as well as the resultant horizontal IPA were calculated. Muscle pre-activation was measured with sEMG from vastus medialis (VM) and biceps femoris (BF) muscles. The sEMG was normalised to maximal dynamic muscle activity detected in level-walking (1.5 m/s) in order to make results comparable. Differences in measured sEMG and SMA parameters between groups were determined by a Mann-Whitney test with significance level of .05.

Results
The axial IPA was 26.5% more pronounced (p=.01) and its attenuation across the knee joint was decreased (14.4%, p<.05) in the knee OA patients during stair descent at 0.8 m/s. The horizontal IPA was 17.6% and 12.2% lower in healthy controls during stair descent with 0.5 m/s and 0.8 m/s, respectively. The patients with knee OA activated their VM prior to contact more forcefully (p<.05) during stair descent at the higher speed (61.3% vs. 48.8%). Furthermore, the co-activity of BF and VM was more evident (p<.01) during pre-activation phase in the knee OA patients. The pre-activation of BF was decreased (p<.05) at both speeds in the patients’ group during stair ascent, but the resultant horizontal IPA was significantly increased in the patients (p<.05) only at faster speed. There was no difference in axial loading or pre-activation in stair descent with lower speed.

Conclusions
The present study demonstrates that patients with knee OA load their lower extremity more forcefully especially during a high-speed stair descent. Knee pain and possible knee joint laxity could partially explain the higher VM pre-activity in the patients' group.

References
Keywords: Electromyography, Osteoarthritis, Stair Use / Stair Climbing

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