Day to Day Variability of Dynamic Knee Joint Stability in Healthy Individuals

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The cause of osteoarthritis remains unknown; however abnormal joint mechanics are speculated to be an initiating factor [1]. Relating the Finite Helical Axis (FHA) to joint health may provide a means of predicting risk of joint degeneration [2]. To study dynamic knee joint stability using FHA and electromyography (EMG), it is valuable to quantify the day to day variance of these measures in a healthy population. It was hypothesized that there would be no statistically significant differences in FHA parameters or muscle patterns between days for healthy individuals. Three healthy females with intact anterior cruciate ligaments were recruited and tested 3 times during one week. Three-dimensional data for FHA determination was collected from reflective skin markers placed on each lower extremity (3 markers/segment) using an 8-camera (120 Hz) video motion capture system (Motion Analysis Corp.). A 16-channel EMG system recorded muscle activation patterns from 6 major muscles of the leg. Each subject performed two dynamic tasks: unconstrained knee flexion and extension while seated, and a single leg squat and rise. Data was analyzed using in house programs written in Matlab 7.1 (Mathworks Inc.). Four FHA parameters were described: location, translation, orientation and dispersion [2]. Muscle activity patterns were quantified using a wavelet analysis approach [3]. Due to the small sample size, a non-parametric Friedman's test was used to detect differences in dynamic knee joint stability between days ($p=0.05$). Significant differences ($p=0.028$) were found for the extension phase of the squat in the contra lateral legs for location y, which describes the anterior/posterior location of the FHA in the knee. No significant differences were detected for any other FHA or EMG parameters. This finding suggests that the y location of the FHA during the extension phase of the squat task changes across days, and must be carefully interpreted in future studies.

References

1. Andriacchi, T.P. J.Biomechanics, 23, Suppl,.1, 99-105,1990.
2. Fjeld, et al., 6th Comb. ORS, (2007).
3. von Tscharner V, et al. J Biomech 36 (8) August:1169-1176, 2003.