SERUM COMP CONCENTRATION IS RELATED TO LOAD DISTRIBUTION AT THE KNEE DURING WALKING IN HEALTHY ADULTS

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INTRODUCTION
Cartilage oligomeric matrix protein (COMP) is a proposed biomarker for cartilage degradation. The loss of COMP from the cartilage (indicated by increased serum levels) seems especially important since it has been suggested that COMP molecules transfer forces from the cartilage matrix to the cell, and thus are involved in the regulation of cartilage synthesis and degradation (Wong et al. 1999). The load distribution between the medial and lateral compartment of the knee during walking measured in terms of the external knee adduction moment has been related to the progression of knee osteoarthritis (OA) (Miyazaki et al. 2002). Yet, a link between cartilage degradation and load distribution at the knee during walking has not been established. The purpose of this study was to test the hypothesis that the change in serum COMP concentration in healthy adults following a 30-minute walking exercise correlates with the knee adduction moment times the number of loading cycles.

METHODS
Ten physically active adults (5 male, 5 female; Table 1) with no history of lower extremity injuries or pain gave informed consent prior to their participation. Subjects self-limited their physical activity 36 h prior to the experiment. Tests began at least 3 h after waking. Blood samples (5 ml) were drawn from the same antecubital vein immediately before and after, and 0.5, 1.5, 3.5, and 5.5 h after a 30-min. walking exercise on a level outdoor walking track at self-selected normal speed. An activity monitor (AMP331, Dynastream Innovations Inc., Cochrance, Alberta) was attached to the right ankle to record basic time-distance measurements of gait including total step count, total distance and average walking speed, cadence and stride length. Serum COMP concentrations were determined using a commercial enzyme immunoassay (COMP® ELISA, AnaMar Medical AB, Uppsala, Sweden). Each subject’s gait was analyzed within one week of the walking exercise experiment. Each subject was instructed to walk at three speeds: slow, self-selected normal, and fast. Kinematic and kinetic data were collected (Andriacchi 1998). One trial per subject and side representing a best match to the time-distance characteristics of the walking exercise was selected. The total load at the knee was defined as the peak external knee adduction moment.

![Figure 1](image)

**Figure 1:** Mean (SD) serum COMP concentration before (-0.5 h) and up to 5.5 h after a 30-min. walking exercise (n = 10 subjects). * significant at $\alpha = .05$. 

[Table 1 is not provided in the document.]
multiplied by the number of steps taken during the 30-min. walking exercise for each subject. Repeated measures ANOVA was used to detect differences in COMP concentration between the six time points. Linear regression analysis was used to relate the increase in serum COMP concentration to the total load at the knee ($\alpha = 0.05$).

RESULTS AND DISCUSSION
This study is the first study to quantify and correlate changes in serum COMP concentration and in vivo loading at the knee during activities of daily living.

Two peaks in serum COMP concentration followed the exercise regimen (Figure 1). The first peak was immediately after the walking exercise and likely represents diffusion of present COMP fragments from the cartilage via synovial fluid into the blood. This immediate increase in serum COMP concentration (9.7%) did not correlate with any basic time-distance measures (Table 1) of gait or the total load placed upon the knee during the walking exercise.

The second peak in serum COMP concentration (7.0%) was 5.5 h after the walking exercise and correlated negatively with the maximum external adduction moment times the number of steps taken during the waking exercise (Figure 2; $R^2 = 0.692$, $P = 0.003$). This peak likely reflects a metabolic response of cartilage to cyclic loading during the walking exercise. The increase in COMP concentration in response to the walking exercise was smaller in subjects with greater loads on the medial compartment of the knee, suggesting less degradation of COMP molecules. Such protective effects of higher loads on the medial compartment at the healthy knee are in agreement with earlier reports (Andriacchi et al. 2003; Koo et al. 2002) of relative thicker cartilage in the medial compartment of the knee in subjects with greater knee adduction moments during walking. The results of our study suggest that the load distribution at the knee during activities of daily living may influence cartilage metabolism.

REFERENCES

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