SERUM COMP CONCENTRATION IS SENSITIVE TO A 14-DAY BED REST INTERVENTION

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INTRODUCTION

Cartilage oligometric matrix protein (COMP) is a structural protein found primarily in cartilage that has been associated with cartilage degradation (1). Serum COMP concentrations are elevated in patients with knee osteoarthritis (2) and rheumatoid arthritis (3). Elevated serum COMP concentrations have also been reported after extensive running exercise of both athletes (4) and after a moderate walking exercise in healthy adults (5). Thus, serum COMP concentration is sensitive to physiological loading and may reflect upon healthy turn-over of cartilage constituents.

During bed rest following an injury or sickness or during spaceflight, the lower limb is unloaded for prolonged periods of time. It has been shown that cartilage atrophies unless exposed to regular mechanical loading (6, 7). However, the biological response of cartilage to unloading during bed rest or spaceflight is unknown. Similarly, it is not known if the effects of unloading can be avoided using a simple and time-efficient exercise regimen. The purpose of this study was to investigate the combined effect of unloading during a 14-day bed rest and daily vibration training on serum COMP concentration.

METHODS

Eight healthy male subjects (78.1 ± 9.5 kg; 179 ± 9.6 cm, 26.4 ± 4.9 years) performed a 14-day bed rest in 6°-head down tilt (HDT) in the metabolic ward of the DLR-Institute of Aerospace Medicine after giving their informed consent. Subjects were moderately physically active and had no injuries at least 12 month prior to the start of the study. The study consisted of two phases, each lasting 23 days and was designed as a cross-over-design where each subject received a training intervention in one phase and no intervention in the other phase. Each study phase was divided into the following periods: a 4-day adaptation phase, a 14-day intervention phase with bed-rest in 6°-HDT and a 5-day recovery phase (Tab. 1). During the training intervention, subjects performed squats twice per day for 5-minutes on a vibration plate (frequency: 20 Hz; amplitude: 2-4 mm). During the bed rest phase, subjects were kept in bed for 24 h at 6°-HDT and were not allowed to elevate their upper body. All activities including showering and weighing were carried out in the 6°-HDT position. Subjects were allowed to walk around the ward in the adaptation-phase and the recovery-phase, however physical exercise was prohibited. Both study phases were identical with respect to environmental conditions, study protocol and diet. In the metabolic ward, controlled daylight exposure, constant room temperature and relative humidity were ensured. Ten blood samples were drawn throughout the study. They were taken in the morning after fasting over night (Tab.2). Serum COMP concentration was analyzed using a commercial enzyme immunoassay (COMP® ELISA, AnaMar Medical AB, Uppsala, Sweden).

RESULTS AND DISCUSSION

Serum COMP concentrations were stable for the baseline measurements at days -3 and -1. After 24h of 6°-HDT bed rest, serum COMP concentration decreased significantly (vib: -10.1%, con: -14.8% p = 0.02). Serum COMP concentration did not change throughout the period of bed rest and returned to baseline levels after subject were mobile again (vib: + 26%, con: + 28.6%, p< 0.001) (Fig.1). The results of this study showed that bed rest results in a reduction in serum COMP concentration within less than two days. One possible explanation for this reduction in serum COMP concentration is a decreased diffusion of COMP molecules from the cartilage into serum due to a lack of exposure of the joint to mechanical loading. This possibility is supported by the fact that serum COMP concentrations returned to baseline within two days following bed rest. Another potential explanation for this result is a change in cartilage metabolism in response to the lack of mechanical stimulus during bed rest.

REFERENCES

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ACKNOWLEDGEMENTS

Dr. Francica May and Christoph Blank for drawing the blood samples and Gabriele Kraus for performing the analysis of the COMP-ELISA. DLR for funding and DAAAD and ISB for co-funding.

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52nd Annual Meeting of the Orthopaedic Research Society

Paper No: 1380