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A Cartilage Stress Test to Assess Risk of Early Knee Osteoarthritis Development in Anterior Cruciate Ligament Reconstructed Individuals

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Objectives

The primary objective of the present study was to assess biomarker responses of the ACL reconstructed knee (ACL-R) compared to the non-injured contralateral knee in an angular tilt paradigm. Secondly, we determined the relationship between kinematic changes at each individual knee and serum biomarker responses.

Design

This crossover sequential study recruited n=16 participants with previous unilateral ACL-R. Participants performed 2 walking trials for 30 minutes each on an angular treadmill that allows 10° lateral tilt and underwent kinematic and blood draw assessments at baseline and 30 minutes. Pain level was assessed using the Numeric Pain Rating Scale (NPRS) and serum was tested for a biomarker of cartilage stress (cartilage oligomeric matrix protein, COMP).
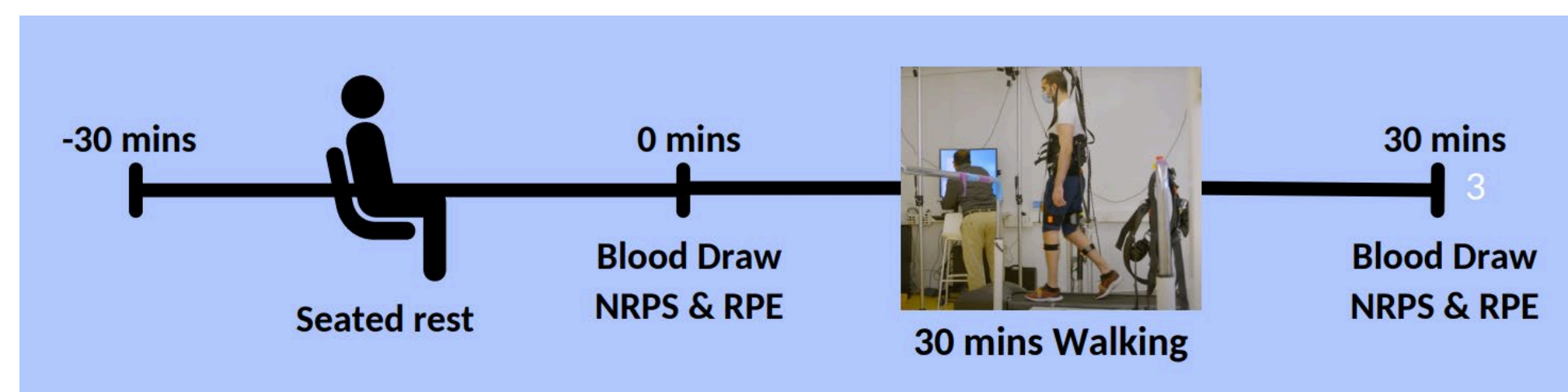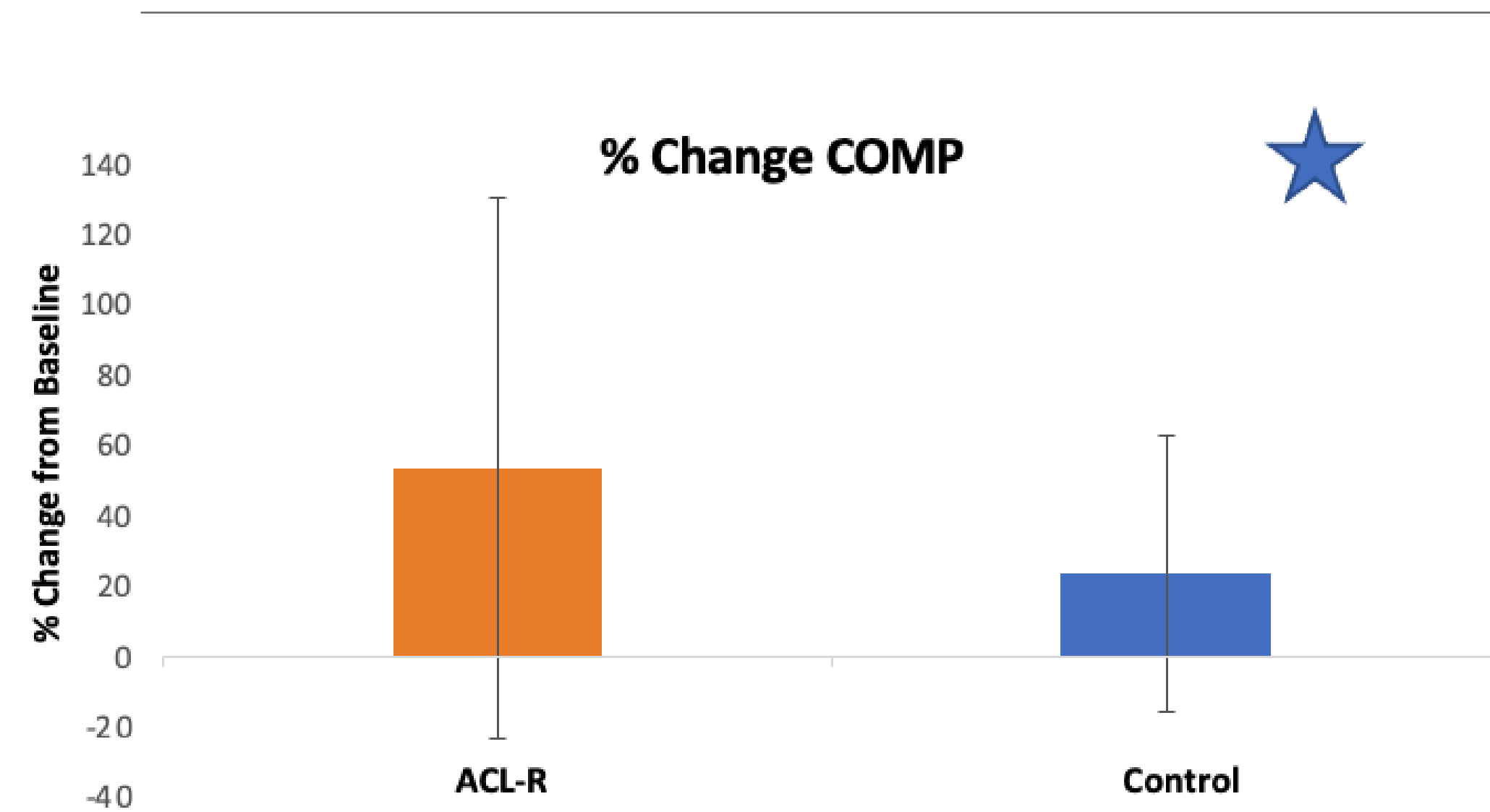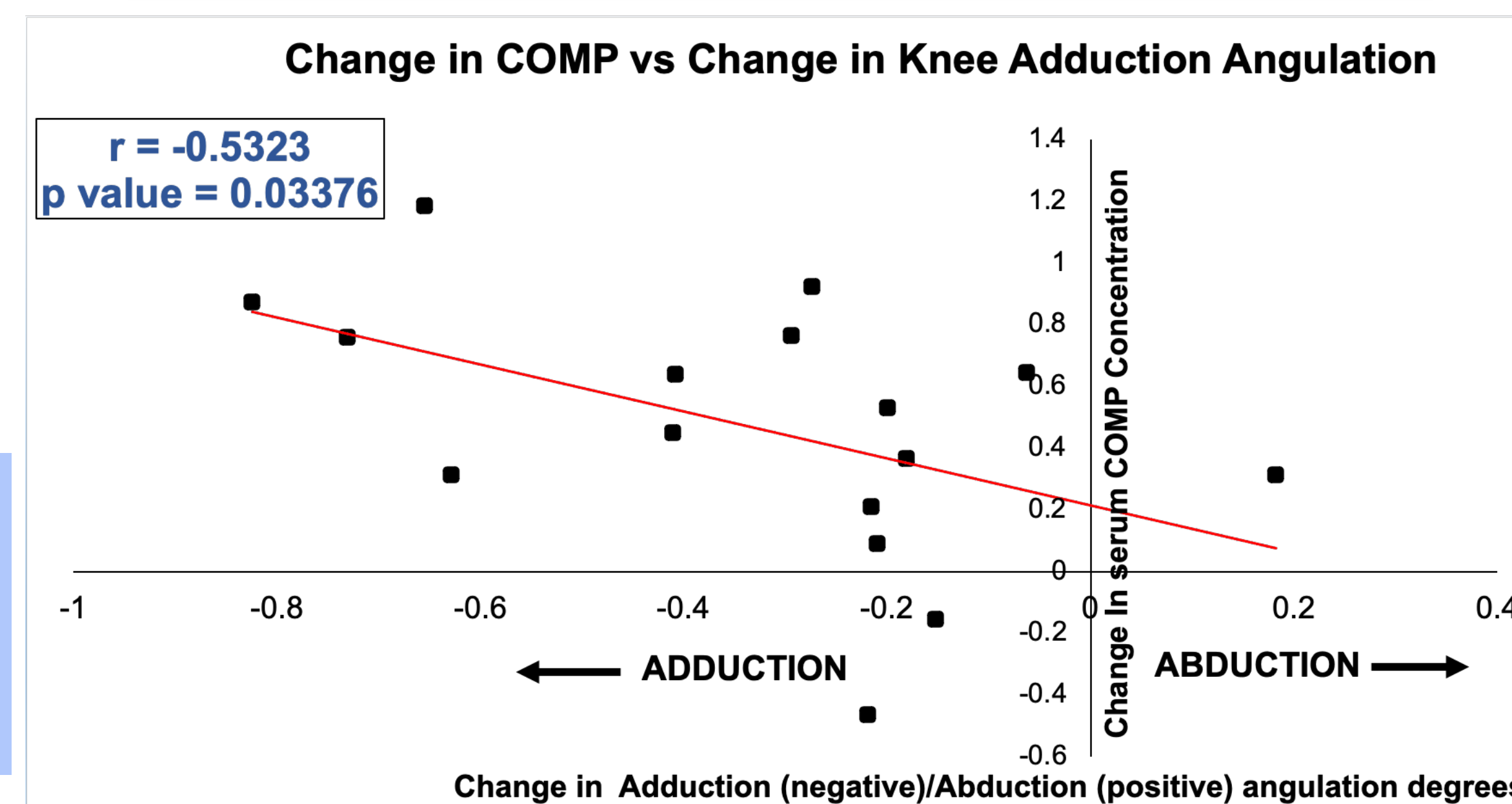

Figure 1

Figure 2

Results

The study cohort had a mean age of 27.3 +/-4.5 and included 5 males and 11 females. When the healthy knee was stressed, COMP concentrations increased by 20.0% from baseline whereas stressing the ACL-R caused a 57.4% increase (p<0.00001). COMP concentrations at 30 minutes when the reconstructed knee was stressed were significantly more elevated than when the healthy knee was stressed (p=0.042). Increase in knee adduction angle at mid-stance (a pathologic gait measure in osteoarthritis) was correlated (r=0.532) with serum COMP concentration when the ACL-R was stressed (p=0.03), whereas change in knee flexion angle showed changes correlated (r=0.514) with serum COMP concentration when stressing the healthy knee (p=0.04).

Discussion & Conclusion

Our angular tilt paradigm identified increases in serum biomarker changes of cartilage stress in ACL-R (without pain) with strong relationships to pathologic gait measures of OA. This study, to our knowledge, is one of the first to find a relationship between biomarker changes and biomechanical changes at an individual knee while walking. Methodology may have significant potential in identifying knees that are at higher risk for developing OA and in-turn allow earlier intervention.

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