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The strain behavior of the anterior cruciate ligament during stair climbing: an in vivo study.

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Stair climbing is a closed kinetic chain exercise that is thought to be useful for knee rehabilitation following anterior cruciate ligament (ACL) reconstruction while protecting the graft from excessive strain. The objectives of this study were to measure the strain produced in the anteromedial band (AMB) of the normal ACL during stair climbing in vivo. We have previously shown that the normal AMB strain pattern during knee passive flexion-extension motion is similar to that of an ACL graft immediately after graft fixation. We successfully tested five subjects with normal ACLs, who were candidates for arthroscopic meniscectomy under local anesthesia. AMB strain was measured in vivo using the Differential Variable Reluctance Transducer (MicroStrain, Burlington, VT). The stair climbing activities were performed on a StairMaster 4000PT (Randall Sports Medicine, Kirkland, WA). Two different climbing cadences were evaluated; 80 and 112 steps per minute. Consistent with our previous studies of ACL biomechanics, strain values increased as the knee was moved from a flexed to an extended position. The mean peak AMB strain values for the 80 and 112 steps per minute conditions were 2.69% (+/-2.89%) and 2.76% (+/-2.68%), respectively. These values were not significantly different. Compared with other rehabilitation activities previously tested in the same manner, the AMB strain values produced during stair climbing were highly variable across subjects. High strain values were observed in some patients but not in others.

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