Knee Tibial Internal-External Rotation after ACL Reconstruction

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Introduction

The main function of the anterior cruciate ligament (ACL) is not only to stabilise the tibia from anterior translation to the femur but also to limit excessive internal/external rotation of the tibia[1,2]. The success of ACL reconstruction is widely evaluated with arthrometers (i.e. KT-1000). However, such an evaluation is actually a measure of joint laxity and not a measure of dynamic joint stability during an activity.

ACL reconstruction was found to restore this increased tibial rotation close to normative values[3] during walking. These results have been challenged in-vitro by Woo et al.[4]. In that study the researchers evaluated the effectiveness of ACL reconstruction to resist anterior tibial load and rotational load *in-vitro*, using a robotic/universal force-moment sensor testing system. They applied an internal-external tibial torque of 10Nm and reported that the current reconstruction procedures using single (bone-pattelar tendon-bone) or multiple (semitendinosus and gracilis tendon) grafts are successful in limiting the anterior tibial translation but they fail to restore tibial rotation. Similar outcomes were reported by Brandsson et al.[5] who measured tibial rotation in ACL patients before and after reconstruction *in-vivo* using a 3-D radiostereometric technique.

The purpose of this study was to examine the internal-external rotation range of movement in-vivo in a high demanding activity. In order to simulate this condition we selected the descending-steps-and-turn movement. We hypothesised that the reconstructed knee will have greater internal-external rotation than the healthy knee.

Statement of Clinical Significance

ACL reconstruction should therefore target not only to diminish anterior tibial translation but also tibial rotation.

Methodology

Ten patients (mean age 23 years; mean mass 73 Kgr) with ACL reconstruction participated in this study. The period between the time of the reconstruction and the examination was ranged between 6 to 40 months. Knee joint laxity was tested wit ha KT-2000 in all patients and side to side differences were less than 3mm. The Lysholm score for all patients was higher than 85. At the time of the examination they reported no functional problems. A six camera optoelectronic system (Peak Performance) was used to capture the kinematic data of the movement. The subjects were asked to descend three steps with their own pace and depending

on the final step on the ground to turn at 90 degrees towards the side to that leg e.g. if the final step was the right they had to turn towards the right side. Fifteen markers set were positioned at specific bony landmarks of the lower limbs to indicate the movements of the lower segments. Segmental angular data of the tibia, and the thigh were calculated from 5 trials for each side. This study only focused only at the internal-external rotation of the knee. Group mean differences between the affected and unaffected sides were examined with a paired t-test at a 95% level of significance.

Results

The reconstructed knee had a greater internal-external rotation (21.5 +/- 5.8 deg) than the healthy side (18.8 +/- 5.6) ($p<0.04$) confirming our hypothesis.

Discussion

This finding is in agreement with in-vitro studies and indicates that ACL reconstruction may not fully restore normal movement especially during loading and extreme rotation conditions. Future research needs to be undertaken on ACL reconstruction not only to prevent anterior translation of the tibial but also to prevent excessive internal-external rotation.

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