Isokinetic profile in female athletes with and without patellofemoral pain syndrome after Anterior Cruciate Ligament reconstruction

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1. Introduction

Anterior Cruciate Ligament (ACL) injury is one of the most frequent injury type in individuals who participate in pivoting sports, with an annual incidence of more than 200,000 cases according to the American Academy of Orthopaedic Surgeons (2007). This has motivated numerous studies on risk factors and prevention strategies (see Griffin et al., 2000 for review), as well as on ACL reconstruction techniques (see Spindler et al., 2004 as an example).

The most prevalent complications after ACL reconstruction are quadriceps weakness, flexion contracture, and patellofemoral pain (Sachs et al., 1989). Patellofemoral Pain Syndrome (PFPS) is characterised by pain around the patella mainly at activities that load the patellofemoral joint like bending knees, walking stairs or kneeling. The origin of the complaints is not fully understood although weakness and/or tightness of the extensor muscles, changes in medial and lateral quadriceps muscle reflex time, patellar laxity and increased navicular drop are suggested to be associated with PFPS (Boling et al., 2009; Witvrouw et al., 2000).

This study therefore aimed at comparing the isokinetic profile in female athletes with and without PFPS to gain further understanding in characteristics and prognosis of PFPS after ACL reconstruction.

2. Methods

One hundred and thirty-nine individuals (28.8 ± 11.9 years) were extracted from a database comprising 201 female patients according to the following two inclusion criteria: a healthy knee and a knee with ACL injury reconstructed using hamstring autograft with the semitendinosus accompanied by the gracilis tendon, and isokinetic assessment at 6-month (±20 days) after surgery. Patients were assigned to one of two groups depending on whether they experienced patella-femoral pain syndrome (PFPS group, n=15) or not (A group, n=124).

Bilateral maximal strength of the knee extensor and flexor muscles was measured using an isokinetic dynamometer (Contrex MJ; Dübendorf, Switzerland), which allowed instantaneous torque recording. Participants were seated with 85° hip angle and with the knee joint rotation axis aligned with the dynamometer rotational axis. They were secured to the equipment with straps across their trunk and thighs, and instructed to push/pull as hard as possible against a pad attached to the distal tibia about 3cm proximally to the lateral malleolus and to complete the full 0-118° range of motion (0° corresponding to knee fully extended). For both concentric and eccentric measurements, knee flexor and extensor trials were performed as discrete movements in a single direction (i.e. non-reciprocal). After a standardized warm-up, participants performed each of the following five conditions: 4 repetitions in eccentric flexion and extension at 30°/s (EF30 and EE30), 4 repetitions in concentric flexion and extension at 90°/s (CF90 and CE90), and 20 repetitions -5 only in case they reported pain - in concentric extension at 240°/s (CE240). Whatever the action mode and the velocity, the maximal peak torque value was extracted, normalized by body weight, and used to calculate the conventional (CE90/CF90) and functional (EE30/CE240) ratios.

All of the data are presented as mean ± standard deviation. After checking for normality, Student’s t-tests or Welch’s tests were applied - depending on whether the assumption of homoscedasticity was met or not - to compare the isokinetic measurements in groups of patients with and without PFPS. The statistical analysis was performed using SPSS 11.0. (SPSS Science Inc., Chicago, IL). The level of significance was fixed at p≤0.05.

3. Results and discussion

The statistical analysis revealed no significant differences between the groups for the healthy knee (Figures 1 and 2). For the operated knee, the PFPS group presented a significantly lower CE90 (p<0.001), CF90 (p=0.05), and EF30 than the A group (figure 1). Moreover, the group PFPS displayed significantly higher conventional (p=0.004) and functional (p=0.007) ratios than the group A (Figure 2).
PFPS is one of the most common complications following ACL reconstruction. However, little research has been done to determine its causal factors. Focusing on kneesokinetic profile, we found an unbalanced strength of the knee musculature as a marker in female athletes, in particular the quadriceps weakness. To decrease the incidence of this chronic injury, this risk factor for PFPS needs to be targeted in prevention programs. A causal relationship between quadriceps and hamstring weakness and PFPS however entail further study.

**References**


