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Relationship between isokinetic and isometric strength assessment methods in ACL- reconstructed patients

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Objectives: The purpose of the present study was to establish the association levels between maximum isokinetic and isometric thigh muscular assessment, 6 months time after ACL reconstruction, as well as to identify significant differences between the isokinetic and isometric assessment according to gender and selected graft: bone-tendon-bone (BTB) versus semitendinosus and gracilis (STG) procedure.

Methods: 85 ACL-reconstructed patients (age=24.8 ± 7.0 years, 16-45 years, weight 73.5 ± 10.6 kg, height = 1.77 ± 0.1 m BMI = 23.3 ± 2.2.) were selected, 57 using a BTB graft and 28 STG graft. 71 were male and 14 female with BTB and STG equally distributed through both genders.

All surgical interventions were performed by the same surgeon and all patients followed similar rehabilitation protocols. Isokinetic and isometric muscular valorisation was performed at 6 months after surgery. Concentric quadriceps and hamstring isokinetic torque was assessed at a pre-set angular velocity of 90°/s and isometric maximal strength assessed at 30° and 90° of flexion for quadriceps muscles, and at 90° for hamstring muscles. Hamstring-to-Quadriceps ratios (H/Q ratios) and bilateral strength deficits were calculated.

Comparative analysis between isokinetic and isometric strength testing modes showed association levels to range between moderate (0.4-0.69) to strong (0.7-0.89) coefficients regarding absolute strength measures, and lower correlation coefficients when comparing bilateral strength deficits and H/Q ratios, ranging from non significant (0.-1.9) to moderate levels (0.4-0.69).

Results: Such results seem to suggest that data gathered under a certain mode of testing does not allow predicting the outcome on a different mode of contraction. When comparing strength values, bilateral strength deficits and H/Q muscular ratios between different groups, either according to chosen graft site or gender, it was noted that significant differences between two groups seem to be reflected regardless the assessment mode. Quadriceps muscular mass was generally more severely affected by the ACL injury and reconstruction process, showing higher strength deficits and H/Q ratios in the isokinetic mode and for the same 90° isometric assessment mode. ACL- reconstructed limb quadriceps strength deficits and H/Q ratios were higher in the BTB group, for both modes of muscular assessment (p<0.01).

Hamstring strength deficits were higher in the STG group (p<0.01), suggesting muscular atrophy after ACL-reconstruction to be related to the chosen graft site. Between genders, no significant differences were found for quadriceps strength deficits (p=0.493 in the isokinetic mode, p=0.450) and p=0.210 in the 30° and 90° isometric assessment, respectively). Hamstrings strength deficits differed significantly however, with females presenting higher deficits than males in

isokinetic ($p < 0.05$) and isometric ($p < 0.01$) modes of assessment, as well as significantly lower H/Q strength ratios ($p < 0.01$), which is consistent with differences in the neuromuscular control strategies identified for both genders.

Conclusions: We consider it would be suitable to conduct further studies using recent instruments and methodology, assessing both modes of muscular contraction in the same dynamometer apparatus, and gathering test-retest reliability coefficients prior to the testing procedure, by this mean bridging the major limitations considered for the present study.