MEASURES OF JOINT LAXITY DURING THE ANTERIOR DRAWER TEST: QUANTIFICATION OF POSSIBLE SOURCES OF INACCURACY

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Introduction

Knee injuries are extremely common and mainly concern cruciate ligaments and menisci. Common techniques used for the evaluation of anterior-posterior and medial-lateral knee stability are fundamentally based on clinical observation and personal experience (e.g. manual drawer test) leading to a wide inter and intra operator variability in diagnosis and prognosis. Thus, the development of many commercial arthometers was promoted by the need of quantitative and more reliable techniques. Few literature studies evaluated the accuracy and repeatability of these devices: intra-operator variability resulted to be low but no gold standard was defined for the evaluation of the accuracy of different systems [Cannon 2002]. Besides, Maitland et al [2002] showed that even if the systems quantify some results of laxity from a test, variables as patient position, operator experience, muscle activity and displacements between device and bones are however causes of inter-tester variability. The aim of this work was to develop a method for quantifying joint laxity, controlling for some possible influencing variables, muscle activity and joint position.

Methods

The prototype of arthrometer built is shown in Figure 1. Fundamental parts were: a handle (a), a *Bertec* six-component load transducer (b), a commercial rigid tibial brace for injuries at the ankle (c) and a connection structure between the load cell and the tibial brace (d). One volunteer participated in the study (28y, 170cm, 63kg). The patient underwent maximal voluntary contraction (MVC) exercises. Three trials of the anterior drawer test were performed by an operator, respectively at 60°, 90° and 120° of knee flexion angle, for a total of nine trials. Thigh, leg and arthrometer kinematics was recorded (SmartD, BTS Italy). Surface EMG (PocketEMG, BTS, Italy) was measured from biceps femoris, vastus medialis, medial gastrocnemius and tibialis anterior. Forces and moments applied by the operator were recorded from the load cell. A model of the arthrometer was implemented in order to remove the effect of its weight on the measures made by the load cell. Forces and moments were referred to the reference system of the tibia in respect to which also the displacement of the thigh was measured.

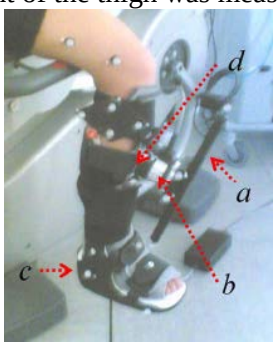

Figure 1: prototype of arthrometer

Results

EMG data confirmed that muscles were relaxed, showing an activation inferior to 5% of MVC. Knee stiffness (N/mm) in the sagittal plane (Tab.1) resulted to be statistically different if the knee was extended at 120°.

	FE knee angle		
	60°	90°	120°
mean	7,5	9,0	17,6
std	0,5	2,2	1,4

Table 1: Knee stiffness (mean and standard deviation) obtained at different knee angles.

Discussion

From the preliminary results of this study the importance of controlling variables as muscle activity and patient position is clear. Future studies will evaluate the possibility of using this method as reference for accuracy evaluation of commercial devices.

References

Cannon *et al*, Sports Med Arthrosc, 10:191-200, 2002
Maitland, Phys Ther Sports, 3:152-157, 2002