Preliminary report on the effects of patient positioning and testing modes on elbow isokinetic measurement

Diane Haering, Charles Pontonnier, Nicolas Bideau, Guillaume Nicolas, Georges Dumont

PRELIMINARY REPORT ON THE EFFECTS OF PATIENT POSITIONING AND TESTING MODES ON ELBOW ISOKINETIC MEASUREMENT

Diane Haering (1), Charles Pontonnier (1,2,3), Nicolas Bideau (1,4), Guillaume Nicolas (1,4), Georges Dumont (1,2)

1. INRIA/IRISA/M2S MimeTIC, France; 2. ENS Rennes, France;
3.Ecoles de Saint-Cyr Coëtquidan, France; 4. Université Rennes 2, France.

Introduction

Strength measurement with isokinetic dynamometer allows the extraction of muscle parameters for performance [1] or clinical [2] assessment. However, misalignment between the fixed axes of the dynamometer and the varying axes of the joint during the movement can lead an angular differences up to 35° [3]. Recommendations for subject positioning and tests settings are limited. The purpose of this pilot study is to identify effects of positioning and testing modes on maximum torque and torque-angle relationship during isokinetic elbow flexion and extension.

Methods

One male adult participated in this pilot experiment. After calibration and warm up on a CONT-TREX MJ dynamometer, two cycles of maximal flexion-extension were performed at 60°.s^{-1} in 10 isokinetic trials followed by one minute breaks. Seating or laying positioning, and CP (Concentric-Passive), CC (Concentric-Concentric), and CE (Concentric-Eccentric) contraction modes were varied in all those trials. Torque, angle and angular velocity were measured by the dynamometer. Pearson's correlation coefficient was computed between the different conditions The effects of positioning, modes and their interactions on maximal voluntary torque were considered.

Results

Figure 1 shows that maximal torques for elbow extension and flexion measured by the dynamometer are larger in seating position than in laying position. Seating upright, extreme extension and flexion torques in CP mode (109/-102 N.m) seems more important than CC (82/-85 N.m) and CE (87/-97 N.m). Inversely laying on the back, measured maximal torque is more important in CC (52/-72 N.m) than in CP (45/-61 N.m) and CE (45/-62 N.m) modes. All combinations of positioning and modes were highly correlated (r>0.7), except between seating or laying in CE mode (r=0.5).

Discussion

Effects of positioning and modes on Torque-Angle relationship are evidenced. In addition, the two factors seem to be interacting. Although differences are identified, correlations between all Torque-Angle relationships suggest they contain repeatable biases. Quantification of individual effects and interaction and identification of errors require a larger number of subjects and tests.

The main result of our pilot study is that seating position seems to allow larger torque production. Since seating condition was performed after the laying one, this discrepancy cannot be attributed to fatigue. Actually, seating position might induce more compensation or less co-activation from other muscle groups than laying position. Moreover, the misalignment between the joint and dynamometer axes may be larger in the laying position and results in larger residuals [4]. In further studies, kinematical measurements will be coupled to ergometer measures to be able to test these hypotheses and estimate errors attributed to each positioning and setting.

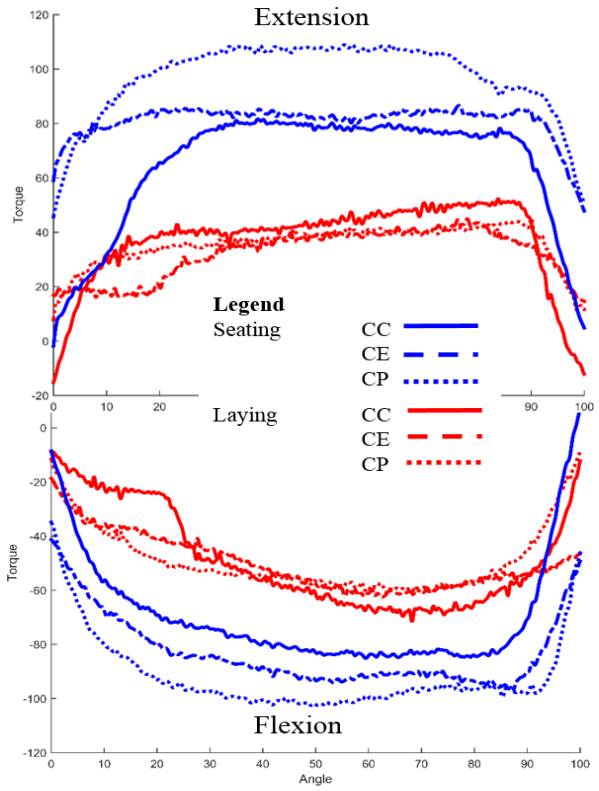

Figure 1: Angle-Torque average relationship in different in different conditions during extension and. flexion cycles.

References

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