VARIATION IN NEUROMUSCULAR PROPERTIES OF THE ELBOW EXTENSOR MUSCLES IN SPORTS STUDENTS

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KEY WORDS: nonlinear parameter estimation, modelling, Hill-type muscle model.

INTRODUCTION: In sports science it is important to know the individual muscle properties for a proper planning of training. Computer simulations can be used to predict the effect of a change in muscle properties on special movements. For this purpose, the knowledge of the appropriate individual values of input parameters is necessary. The aim of the study is to investigate the individual differences of movement independent properties of the elbow extensors.

METHOD: 7 male and 5 female sports students (26.2 ± 5.4 yrs, 1.76 ± 0.10 m, 71.8 ± 8.5 kg) performed 4 dynamic and 2 isometric movements with MVC on a purpose-built inclined arm press. Based on the measured data of force, velocity, and position as functions of time, muscle parameters of the *model elbow extensor muscle were determined non-invasively and in vivo by nonlinear parameter identification* using a Hill-type model including the activation (Siebert, Sust, Thaller, Tilp, & Wagner, 2007; Kickmeier, 2007). Among others, Hill's parameters a, b, and c describing the force (f) – velocity (v) relation in the muscle via $f = c/(v+b) - a$ are identified, thus getting the isometric force $f_{iso} = c/b - a$, and the parameter b_n, defined as b normed to the muscle length.

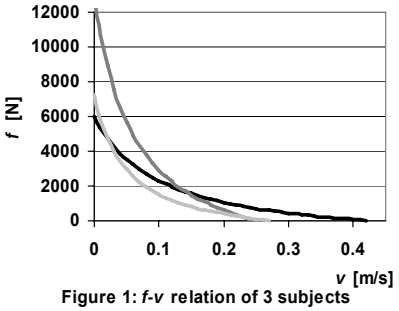

Figure 1: *f-v* relation of 3 subjects

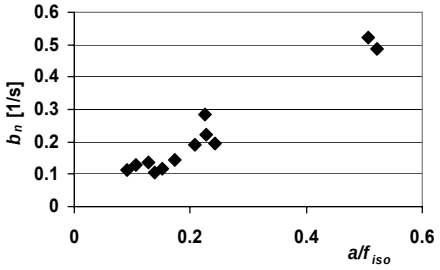

Figure 2: Relation between b_n and a/f_{iso}

RESULTS AND DISCUSSION: Figure 1 shows the variety of the force-velocity relation of three subjects, Figure 2 shows the relation between b_n and a/f_{iso}. The parameter b_n correlates with the fiber distribution (Sust, Schmalz & Linnenbecker, 1997), a/f_{iso} describes the curvature of the force-velocity relation in the muscle and correlates with the efficiency (cf. e.g., Thaller & Wagner, 2004). The results show the large differences between the subjects, all being sports students. Muscular properties, in particular the fiber distribution, play an important role in sports. Therefore, the individual determination of such movement independent properties is fundamental in training science. Further investigations will show the variation in these properties between subjects performing different sports.

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