Reliability of a practicable EMG-moment model for antagonist moment prediction

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Introduction
An approach to determine individual muscle moment contribution to the resultant joint moment during static and dynamic activities is to develop mathematical models to predict individual muscle forces using muscle electromyography (EMG) as an input. Several research studies have modelled the EMG-force relationship taking into consideration physiological and mechanical factors that affect this relationship (Kellis, 1998). However, such models are time consuming and very difficult to apply in clinical practice. For this reason, recent studies have developed simpler practicable EMG-moment models under isometric and isokinetic isolated joint conditions to predict muscle moments around the knee. Recent studies (Doorenbosch and Harlaar 2003) have suggested that this method provides a reasonable estimate of muscle moments around the knee. Such information can be useful in several situations, especially in clinical practice (Doorenbosch and Harlaar 2003). Should practicable EMG-force/moment models be applied in clinical practice, the repeatability of the estimated moments using such models is of primary importance. The purpose of this study was to apply an EMG-moment model to predict the antagonist moment of the knee flexors (Mflx) during maximal isometric knee extension efforts.

Methods
Nine healthy males performed maximal isometric knee extension and flexion contractions at 0°, 45° and 90° angles with recordings of the net moment and EMG of thigh muscles. Calibration knee flexion efforts were performed at different levels of intensity and the resulting EMG-moment curves were fitted using second-order polynomials. The polynomials were then used to predict Mflx. (Fig 1)

This procedure was repeated a week after. Analysis of variance designs were used to compute the reliability coefficients for each measured variable.

Results
The results indicated non-significant differences in test-retest Mflx. Intraclass correlation coefficients ranged from 0.852 to 0.912 indicating high test-retest reliability of the estimated Mflx. (Fig. 2). The rms error ranged from 6 to 15% of the actual recorded moment.

Discussion/ Conclusion
The present results indicated that Mflx predicted using a practicable EMG-moment yielded high test-retest reliability. These results further support the use of such models for quantification of muscle moments/forces around the knee with a reasonable error estimate and high test-retest reliability.

References