COMPARISON OF MOMENT-ANGLE PROFILE OF ELBOW FLEXORS –
EXTENSORS IN ELITE YOUNG OVERHEAD ATHLETES

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INTRODUCTION

In in-vivo conditions, the moment vs. joint angle curve (M-A profile) is typically used to examine the force-length characteristics of muscles. During attack in volleyball (VB) and water-polo (WP), the elbow moves through an arc of ≈60°-70° joint flexion suggesting that the flexor and extensor muscles operate in similar joint configurations, therefore muscle lengths. Previous studies (Herzog et al., 1991) have shown different extensor moment-knee angle relations between different athletes that were attributed to adaptation of muscle function to different functional requirements. The purpose of this study was to compare the moment-elbow angle profile between elite young overhead athletes.

METHODS AND PROCEDURES

The sample consisted of 10 elite young VB and 10 WP athletes with body mass, height and age values (mean±SD) being 80.0±8.0 kg, 185.7±5.1 cm and 17.2±1.0 years, and 76.1±15.0 kg, 174.8±8.0 cm and 15.2±0.9 years, respectively. Subjects executed 3.0 sec maximum dominant elbow flexion–extension contractions on a Cybex II+ dynamometer at angles of 45-60-75-90-105-120° of joint flexion (0°=full extension) in a random order, being in a supine position with the shoulder joint at 45° of horizontal abduction and the forearm in neutral position. Maximal isometric flexor–extensor moment (Nm) was calculated. Data collection (Fs=1000 Hz) and data analysis used the AcqKnowledge software. A 2nd-order polynomial curve fitting approach was used to predict the M-A profile and the optimal elbow joint angle (Aopt) for moment production. Possible differences in Aopt of the M-A profile and in the flexors-extensors moment magnitude across tested elbow joint angles between groups were examined with t-test for independent samples and univariate anovas, respectively (p<.05).

RESULTS

In both groups, results showed that the flexor moment was stronger on positions of greater elbow joint extension and was reduced as the joint became more flexed (Figure 1), while the extensors showed a relatively constant moment-generating capacity over the range of the tested elbow angles (Figure 2). The predicted Aopt of the flexors M-A profile was at 72° and 70° and the corresponding one for the extensors M-A profile at 74° and 70° of elbow flexion in VB and WP athletes, respectively, however no significant differences were observed between groups. VB athletes generated higher elbow extensor moment than WP athletes at 45° of elbow joint flexion (Figure 2), whereas no significant differences between groups were found for the flexor moment (Figure 1).
DISCUSSION

Present results agree well with previous studies on the isometric functional capacity of the muscles crossing the elbow (Murray et al., 2000). The identical shape of the elbow flexor – extensor M-A profile in VB and WP athletes suggests similar adaptations of the elbow muscles to similar functional requirements. However, the observed difference in the extensor moment magnitude between groups at the joint configuration of greater elbow extension, which is more frequently seen in volleyball, provides evidence for adaptations of muscle function that may either relate with different competition conditions (Herzog et al., 1991) or may result from existing differences in muscle volume between groups, which become more pronounced in critical elbow joint angles for these sports. Further research where other factors that could affect the shape and magnitude of the M-A profile of athletes with specific long-term physical activity at the elbow joint can be examined is necessary.

SUMMARY

This study compared the profile of possible changes in the elbow flexor – extensor maximal moment as a function of changes in the elbow joint angle (M-A profile) between two groups of elite young overhead athletes. The shape of the M-A profile of the elbow flexors – extensors was similar between groups, however a difference found in the extensor moment magnitude may be associated with different elbow joint configuration during training and/or competition, thus providing evidence for adaptations of muscle function to specific functional requirements.

REFERENCES


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