CHARACTERISTICS OF MUSCLE ACTIVITY IN DISTAL AND PROXIMAL UPPER EXTREMITIES IN DIFFERENT PHASES FOR TAIWAN OLYMPIC FEMALE ARCHERY PLAYERS

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INTRODUCTION

The performance ofan elite archer can be affected by effective control of muscle in the upper extremities. Moreover, archery can be described as a comparatively static sport requiring strength and endurance of the upper body, in particular of the forearm and shoulder girdle [1]. Thus, EMG provides useful information to investigate the static skill sof archery. So far, a contraction and relaxation strategy with regard to forearm muscles during the release of the bowstring has been observed and studied through EMG for different skill levels of players [2,3]. These studies showed that archers released the bowstring by active contraction of the forearm extensors, whereas a clear relaxation characterized the forearm after release. Improper contraction may lead the incorrect movement and hasten fatigue of the muscle, as seen in beginner archers. However, most studies of the relaxation of release only focus on either the forearm or certain shoulder muscles (e.g., the right trapezius). There is no study that investigates how different contraction and release strategies might apply from the distal to proximal segments of the upper extremities, especially in world rank elite archers. Thus, the purpose of this study was to (1) investigate this strategy in the limb extremities from distal to proximal segments using Olympic Female Archery Players, (2) quantify relaxation strategy which was indicated by reduction in muscle activation before and after the release, and (3) determine the characteristic of reduction level of muscle activities in supplemental studies of anchoring and aiming. These studies can provide archers and coaches with the possible assessments of optimal skill patterns.

METHODS

The Chinese Taipei 2004 Athens Olympic archery team was used in this study. The national rankings of team members were Archer A: fourth position, Archer B: sixth position, and Archer C: fiftieth position. Measurements were made under simulated Olympics conditions on the outdoor court of the Taiwan National Training Center. Biovison surface electrodes were placed on the central portion of each muscle. Electromyography activity of the M. extensor digitorum, trapezius muscle, and deltoid muscle were recorded at a sampling frequency of1000Hz using synchronized electronic signals for 24 shots by each participant. The mean amplitude of EMG activity during (1) one second of pre- and post-anchoring start point, (2) pre- and post- release timing, and, (3) the first second and last second of the aiming phase were obtained using standard processing. Reduction in the level of muscle activity at anchoring and release were calculated to evaluate release skill in the 0.1 s duration prior to (X) and after specific timing (Y) using the following equation:

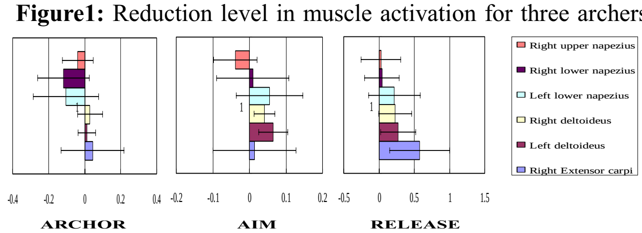
$$\text{Reduction in muscle activity} = 1 - Y/X \qquad (1)$$

A higher positive reduction ratio represented a higher reduction in muscle activation, whereas a negative value represented an increase in muscle activation.

RESULTS AND DISCUSSION

The reduction ratio is shown in Figure 1 from proximal to distal segments for three phases. A greater reduction of muscle activation was seen in the more distal of muscle groups at release. However, anchor and aiming phases did not exhibit such a tendency. During the aiming phase, the extensor carpi of the draw arm increased , unlike other muscle groups. During the anchor phase, proximal muscle groups increase activation whereas distal muscle groups tend to reduce activation.
onthe other hand Reduction levels and variation in activation were compared among players using One-way ANOVA and post-comparisons (LSD). There were no significant differences between the three archers in reduction of muscle activation during anchoring and release phases. However, during the anchor phase, player A exhited a significantly greater reduction level relative to other players for the distal muscle groups (right extensor carpi, left detoideus, and right detoideus). This may imply that player A with a better performance may be due to a better relaxation strategy that yields more consistent performance.

Figure1: Reduction level in muscle activation for three archers



in three phases. (n=72)

CONCLUSIONS

This study indicates that the proximal muscles exhibit a lower redu ction level of muscle activation than do distal muscles for three archers after release. Archer A with a better Olympicsranking had the more coherent reducing muscle activation for all muscle groups at release phase, and reduced with distal muscle group during aiming phase. This may imply such relaxation strategy leads to better performance.

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