原　著

投球動作時の姿勢筋の疲労回復にともなう姿勢協同筋活動の経時的変化

The time course of postural synergistic activities during recovery from fatigue of the postural muscles on throwing movement in a standing position

伊東太郎[1)]　南本裕介[1)]　渡邊完児[2)]　井上芳光[3)]　山下謙智[4)]

Taro Ito[1)] Yusuke Minamoto[1)] Kanji Watanabe[2)] Yoshimitsu Inoue[3)] Noriyoshi Yamashita[4)]

Abstract

The purpose of the present study was to elucidate the time course of changes in task performance and electromyographic (EMG) activities of postural synergistic muscles involved in the anticipatory postural adjustments (APA) associated with a task of throwing a 2-kg load underhanded as fast as possible during recovery from postural muscle fatigue. Eleven healthy adults performed throwing movement before and after concentric-eccentric contractions (30% MVC weight) of the bilateral tibialis anterior muscles (TA) sustained to exhaustion. The throwing velocity and EMG amplitudes of the postural synergistic muscles (TA, long head of m. biceps femoris (BF), and m. erector spinae at the level of L4 (ES)) in the APA were recorded to assess APA recovery from fatigue using a recovery-time histogram every 45 sec. EMG activity of the TA muscle immediately after dorsiflexion sustained to exhaustion disappeared during the throwing movement. In contrast, the EMG activities of ES ($P = 0.007$) and BF ($P = 0.272$) increased with TA muscle inactivity. After 45-sec recovery, these EMG discharge patterns and amplitudes were restored to those of the control trials without performing a fatigue protocol. The reduced throwing velocity returned to the non-fatigue level 225 sec after the termination of the fatigue protocol. These findings indicated that this specific muscle activation pattern between postural synergistic muscles, i.e., alternate muscle activity, compensated for the impaired TA muscle activity. In conclusion, these results suggested that the central nervous system had the ability to inactivate exhausted postural muscles and selectively recruit other postural synergistic muscles in order to maintain high-level task performance and postural stability.

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[1)] 大阪青山大学　健康科学部　健康栄養学科　*Department of Health Sciences, Osaka Aoyama University*
[2)] 武庫川女子大学　文学部　健康・スポーツ科学科　*Department of Health and Sports, Mukogawa Women's University*
[3)] 大阪国際大学　人間科学部　スポーツ行動学科　*Laboratory for Human Performance Research, Osaka International University*
[4)] 運動科学研究所　*Institute of Movement Science*