正常年輕人斜坡慢跑時下肢肌電活化之探討

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摘要

近年來很多人選擇在健身中心或是住家的跑步機上進行慢跑運動，其中跑步機上的可選擇模式主要是速度及斜坡。增加斜坡不只會造成心肺負擔增加，同時也可能影響下肢各關節肌肉活化型態。過去文獻中缺乏完整且系統地應用肌電圖分析來探討不同斜坡坡度的效應，因此本研究將探討四種不同斜坡坡度(0%, 5%, 10%, 15 %) ，對下肢各重要肌肉活化型態和程度及膝關節運動學的影響。 受測者平均年齡 21.3 歲，男、女性數目皆為 20 人，合計共 40 人；使用的設備主要為：肌電訊號系統(EMG system) 和電子量角器。表面電極擺放在下列四個肌肉群：股直肌(rectus femoris)、股二頭肌(biceps femoris)、內側腓腸肌(medial gastrocnemius)和脛前肌(tibialis anterior)；電子量角器則擺放在膝關節外側，量測膝關節在運動時的彎曲角度；取樣頻率皆設定為 2000Hz。 結果顯示，慢跑時斜坡坡度增加會使股直肌、脛前肌和內側腓腸肌活化也隨之增加，但股二頭肌活化程度卻隨之減少。股直肌和內側腓腸肌活化增加，與坡度增加所需下肢前進動力增加相關；而脛前肌在擺盪期的活化增加，則和坡度增加時足部離地角度需求增加有關。股二頭肌肌活化程度減少，可以因此增加膝關節伸直淨力矩，幫助坡度增加時下肢前進動力來源。 經由系統化地肌電圖分析探討斜坡對下肢各主要肌群活化型態的影響，可以幫助臨床復健醫療人員或運動教練，針對慢跑者特定肌群訓練的決定。

關鍵字：慢跑、斜坡、肌電圖、生物力學

Muscle Activation in Lower Limbs During Incline Jogging in Normal Young Subjects

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Abstract

Recently there is an increasing trend that people get to jog with a treadmill conveniently at gym or home settings. One of the main available modes selected for treadmill jogging is the slope of incline. Increased incline slope will contribute to enlarge the cardiopulmonary loading and alter the activation type of muscles in lower extremity (LE). In previous literatures, the systematic investigation of EMG analysis on the effect of LE muscles is rare. This study aims to examine the activation patterns of the muscles in LE and the knee joint angle during jogging on four incline slopes (i.e. 0%, 5%, 10%, and 15%). A total of 40 young healthy collegiate subjects (mean age 21.3 years), with 20 male and 20 female, were participated in this study. The equipments used in this study included EMG system and electrogoniometry (BIOPAC System, Inc.). The surface electrodes were placed on the four muscles: rectus femoris, biceps femoris, medial gastrocnemius and tibialis anterior. The electrogoniometry was placed on the lateral side of knee to measure the knee flexion angle during motion. All equipments were set to collect the data synchronously with sampling rate 2000Hz. The results indicated that the activation level of rectus femoris, medial gastrocnemius and tibialis anterior muscles were increased with the increased incline slope during jogging. Interestingly, the firing of biceps femoris was decreased with the increased incline slope. The greater activation of rectus femoris and medial gastrocnemius is correlated to the increased required progression power as increased incline slope during stance phase. During swing phase, the increased activation of tibialis anterior is relevant to the increased required ankle dorsi-flexion angle for foot clearance as increased incline slope. As the incline slope increased, the diminished firing of biceps femoris helped to on increase the net knee extensor moment and then the progression power is increased. Through the systematic EMG investigation of the lower limb during an incline jogging, it can help us to understand its effects on muscle firing pattern. This information might provide the clinicians in rehabilitation fields and coach a guideline for selective training a specific muscle group.

Key Words：Jogging, Incline, EMG, Biomechanics