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ORIGINAL ARTICLE

Evaluation of two muscle training programs by assessment of the muscle tone



Évaluation de deux programmes d'entraînement musculaire par détermination du tonus musculaire

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Decrement;
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Assessment

Summary

Background. – Muscle parameters like muscle tone and elasticity are important for development of the training program in relationship with speed reaction and to maintain the body position. **Objectives.** – We propose to make a comparative study between two types of muscle training using myotonometry to estimate the muscle tone.

Equipment and methods. – We make a comparison between two types of muscle training for two athletes (age –18 years) that participate at two different muscle training programs. The assessment of muscle parameters included: muscle tone (frequency F), elasticity (decrement), stiffness and index force, by myotonometry for rectus femoris (RF) and tibialis anterior (TA). The training program: develop the execution speed by increasing explosive strength-training program T1 of the lower limbs versus the training program which aims to develop the maximum force by isometric exercises T2.

Results. – We observe that for RF, F has a symmetry right/left for T1 and very close to norms, but at the same time for T2 we observe a high difference between right/left side, and high value for RF left side, that means an overuse of muscle group and an important decrease of the RF right side, that means muscle fatigue.

Conclusions. – The results of muscle tone assessment by myotonometry can be an indicator for fatigue. The training program based on plyometry, stretching and development of speed, improve the muscle parameters and reduce the risk of muscle fatigue and muscle injury. At the

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MOTS CLÉS

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same time the T2 training program, based on isometric contraction and static strength training, increase the asymmetry between right and left side and also decrease the elasticity.

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Résumé

Contexte. – Paramètres musculaires comme le tonus musculaire et l'élasticité sont importants pour le développement du programme de formation en relation avec la réaction de vitesse et pour maintenir la position du corps.

Objectifs. – Nous proposons de faire une étude comparative entre les deux types de préparation/entraînement de muscle en utilisant myotonométrie pour estimation des méthodes de tonus musculaire. Nous faisons une comparaison entre les deux types de formation de muscle de deux athlètes (âge : 18 années) qui participent à deux différents programme de formation de muscles. L'évaluation des paramètres musculaires inclut : tonus musculaire (fréquence de F), l'élasticité (décrémentation), la rigidité et la force de l'index, par myotonométrie pour rectus femoris (RF) et tibial antérieur (TA). Le programme de formation : développer la vitesse d'exécution en augmentant de façon explosive le programme de musculation T1 des membres inférieurs par rapport au programme de formation qui vise à développer la force de maxime par des exercices isométriques T2.

Résultats. – Nous observons que pour RF, F a une symétrie droite/gauche pour T1 et très proche des normes, mais en même temps pour T2, nous observons une grande différence entre le côté droite/gauche, et de grande valeur pour RF côté gauche, qui signifie une sur-utilisation du groupe musculaire et une diminution importante de RF à droite qui signifie la fatigue musculaire.

Conclusions. – Les résultats de l'évaluation de tonus musculaire par myotonométrie peuvent être un indicateur de la fatigue. Le programme de formation, sur la base de pliométrie, d'étirement et de développement de la vitesse, améliore les paramètres musculaires et réduit le risque de fatigue musculaire et blessures musculaires. En même temps, le programme de formation sur la base de contraction isométrique T2 et de la formation de force statique augmente l'asymétrie entre droite et gauche et aussi diminue l'élasticité.

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1. Abbreviations

RF	rectus femoris
TA	tibialis anterior
T1	training program 1
T2	training program 2

2. Introduction

Most of physical activity, especially sports activities, require muscle balance and muscle strength to increase stability. These aspects need a perfect physical preparation because some of the actions are explosive actions and the struggle occurs when the athlete tries to overcome his partner through rapid execution, based on isolated or chained technical manoeuvres [1]. In order to obtain greater stability and development, the explosive muscle force in explosive actions, the required means to have a combination of strength, speed and synchronized movement of the lower limb joints. For the throwing technique to be effective, it must be executed both very quickly [2], and with great muscular strength [1]. During some sport competition the actions must perform quick and sudden changes. From this point of view some authors consider that is important to have the following phases: well-timed

pre-activation of the muscle, before the onset of the eccentric phase, a short and fast eccentric phase, an immediate transition between the eccentric and concentric phases of action.

These aspects must be understood for muscle preparation to be effectively delivered during the training process and in order to increase the mechanical muscle properties focused on elasticity, important in the development of the elastic-explosive phase that can involve the performance of a reactive task – the countermovement jump. In other words, it is important to develop these properties in order to increase the high force impulse action [3], or the capacity to move quickly from the eccentric to the concentric phase of muscular action.

Muscle tone is the result of nervous system action and is also based on the muscle structure, but not only muscle fibres, because conjunctive tissue affects the muscle tone and elasticity. Muscle tone has an indirect [3] effect on muscle vascularisation (vessels) but the effect is also reciprocal, from the vessels onto muscle. One of the methods of muscle tone assessment is myotonometry and this allows having numeric values for stiffness, decrement, frequency and elasticity. Muscle tone reflects the possibility to restore the physiological properties of muscle between effort stages. Stiffness is a muscle property that constitutes the response to an external force and is associated with antagonists' muscle resistance. Skeletal muscles are a viscoelastic material, that support mechanic [4] tasks and store the elastic energy

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