THE STRUCTURE OF MUSCULAR ACTMTY IN CYCLIC LOCOMOTIONS

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The direction of the human motion is regulated by the interrelationship of central and peripheral cycles of motionary apparatus and the environment. (N.A. Bernshteyn: 1935) Muscular activity is the resulting parameter of the central (reflectory) cycle and demonstrates the combination of the following changing parameters: quantity of recruited motionary units, frequencies of motionary units' impulsation and the duration of their activity. The duration of muscular activity in locomotory cycle is the most labile factor which ensures the immediate adaptation of the motor apparatus to the surrounding conditions of the environment. (I.M. Kozlov, 1966) The problem of temporary organization in muscular activity was studied under the influence of outer loading (capacity of the work done). It corresponded to the velocity of pedalling 20-70 km/h with an interval of 10 km/h. The duration of the electrical activity was registered from rectus femoris, vastus lateral bicep femoris and gastrocnemius. The results of the duration of electrical activity, measured in 6 cases (6 cyclists) were approximated with polinomials of the second order by the method of least squares. The use of second-order polinomials is connected with the duration of electric activity in muscles and it shows that the dependence in duration is nonlinear according to the tempo of motion.

The following regression equations define the dependence of electrical activity in muscles and the tempo of motion:

$Y_1 = 106m7\,x^2 - 499.6x + 763.2$ (1)
$Y_2 = 58.9x^2 - 328.6x + 700.1$ (2)
$Y_3 = 136.9x^2 - 606.6x + 872.6$ (3)
$Y_4 = 122.1x^2 - 684.1x + 1143.1$ (4)

where Y_1, Y_2, Y3, Y_4 - is the duration of electrical activity; x - tempo of pedalling.

The increase in the tempo and the duration decreases according to a nonlinear law. The period of electrical activity increases in muscles, providing motion in the proximal joints: m. rectus femoris - 23%; m. biceps femoris - 11.9%; m. vastus lateralis - 6.2%

The relative duration of electrical activity characterizes the length of muscular application in the motory cycle. The increase in the indices shows in the increase of muscular work with an increase in loading.

With the maximum tempo of pedalling (2.7 cycles) the muscles succeed in developing strength equal to 75% from maximum isometric strength (Morris et a1.1983). This means that the increase of capacity of work may be achieved by an increase in muscular contraction.

The velocity of muscular contraction was calculated according to model A. Pedotti (1977), according to data obtained from cinematographic analysis indicated that the frequency was 70 k/s. When the tempo of pedalling increased from 0.8 - 2.7, the contraction in the concentric regime increased in m.rectus femoris from 17.5 till 28 sm/s, in m.biceps femoris - 10.5-17.5sm/s, in m. vastus lateralis - 17.5-45.5 sm/s, and in the eccentric regime it changed relatively from 14.0 to 31.5, from 10.5 to 21 and from 17.5 to 42 sm/s, respectively. The increase in the contraction in the muscles connected with the increase of the movement tempo is likely to be related to the activation of rapid motionary units according to stretch-reflex mechanism.

The increase in motion changes the distribution in the motionary cycle during the beginning and the end of electrical activity in muscles. The quicker the motion, the earlier is the beginning and the end of the electrical activity. The beginning of electric activity in muscles forestalled the cessation on at least 2 occasions. The growth of motion tempo increases the periods of simultaneous activity of muscle-antagonists. It increases the joints' severity and increases the quickness of the movements.