

IMPROVEMENT OF THE COMPUTER COMPLEX FOR ADAPTIVE ELECTRICAL STIMULATION TAKING INTO ACCOUNT ARTHROSCOPY DATA

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The features of the construction of a biotechnical complex for adaptive electrical stimulation of human muscles are considered. The selection of stimulating signals of different contractility is carried out taking into account the individual state of the human neuromuscular apparatus. The complex allows monitoring the effectiveness of rehabilitation procedures by registering the electromyogram signal, matching the parameters of the electrical stimulation signal with the characteristics of the muscles, as well as with the data of diagnostic arthroscopy.

Joint arthroscopy is a modern surgical technique that allows for the diagnosis and treatment of joint pathologies “without an incision”. A video camera and special instruments are inserted into the joint through two small punctures (up to 5 mm). With their help, the surgeon performs all the necessary actions inside the joint: thanks to the microscopic video camera, he sees an enlarged image of the knee joint from the inside on the screen. Subsequently, individual rehabilitation programs quickly restore lost functions also due to electrical stimulation. Therefore, it is proposed to improve the electrical stimulation system, which takes into account EMG signal data [1-4] and diagnostic arthroscopy images.

The figure shows the structure of the proposed computer complex, where arrows indicate information channels indicating the direction of information transmission, and blocks indicate system elements.

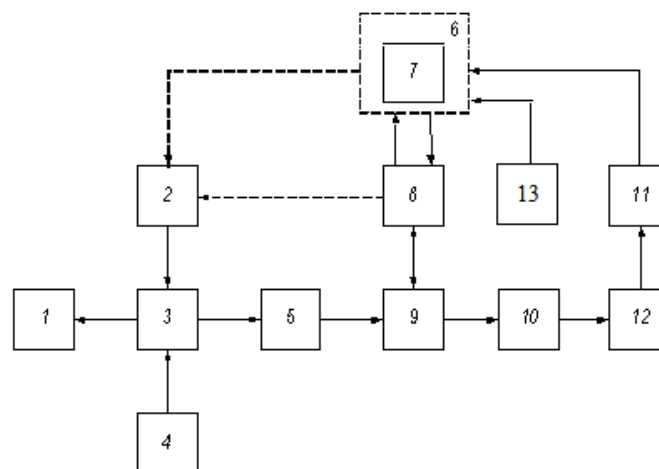


Figure – Structural diagram of the complex for electrical muscle stimulation

The figure shows:

1 – mode display device (MDD); 2 – parameter setting device (PSD); 3 – electrical stimulator (ES); 4 – control device; 5 and 10 – electrode systems (SE1 and SE2); 6 – personal computer (PC) with special software (SS) (7); 8 – decision maker (DM), for example, a doctor; 9 – patient; 11 – coordination device; 12 – electromyograph (EM); 13 – device for inputting images based on the results of diagnostic arthroscopy (DA).

The main elements of such a complex are an electrostimulator, a myograph and a patient. The microprocessor-based electrostimulator forms a sequence of electrical impulses with specified parameters. Electrodes CE1 transmit impulses to nerve endings, as a result of which the muscles actively contract. Electromyogram signals are recorded through electrodes CE2, processed by the myograph EM and entered into the PC through the matching device. With the help of the SS, electromyograms and the results of diagnostic arthroscopy are analyzed and their main parameters are determined. Based on these data, the DM can change the parameters of stimulating effects through the PSD. During rehabilitation procedures, appropriate models of stimulation characteristics are formed to obtain optimal parameters of effects and their adequacy is assessed [5].

Such structure allows to increase the efficiency of rehabilitation procedures and significantly reduce the time.

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