

ROLE OF FUNCTIONAL ELECTROMYOSTIMULATION IN IMPROVEMENT OF HAEMODYNAMIC AND MOTOR FUNCTION OF SKELETAL MUSCLES

Raimundas Kibiša
Kaunas Medical University, Clinic of Rehabilitation
Eivenių 2, 3005 Kaunas, Lithuania
e-mail: reabilitacija@kmuk.balt.net

Abstract - A working hypothesis has been suggested that transcutaneous electromyostimulation of lower leg improves the most important vegetative, i.e. haemodynamic and motoric functions exerting influence on industrial fatigue. With this aim in view over 200 women workers at different factories of Lithuania engaged in the sitting type of work at assembly-line have been examined directly at their working place. The results of the investigation have proved the validity of the working hypothesis about a positive influence of electromyostimulation in restoring the vegetative functions mentioned above. This also contributed to lessening of industrial fatigue in workers.

Keywords: 1. Electromyostimulation, 2. Industrial fatigue, 3. Industrial hypokinesia, 4. Haemodynamic function, 5. Motor function, 6. Electroplethysmographic research, 7. Electromyographic research

1. Introduction

The progress of technology is connected with negative influence of industrial hypokinesia on the skeletal muscular nervous system of the worker. It is especially evident in the type of the assembly-line work which is bound up with the sitting posture of the worker. The prevailing isometric character of muscular activity especially wears out the neck, shoulder girdle, back and leg muscles. Due to the disorder in the functioning of the muscle venous pump the peripheral circulation in the leg muscles, especially in the muscle triceps surae, is deranged. Here accumulates up to 31.5 per cent of venous blood which contributes to the rise of industrial fatigue and decrease of the working capacity. Electrical stimulation of skeletal muscles improves their trophicity and diminishes tiredness [1, 2, 3]. However, the problem has still been insufficiently studied. All of the previous methods employed suffer at least from the following two drawbacks: first, the worker is being withdrawn from the working process and second, rehabilitation is being performed after the working shift.

A method proposed by us is free of the drawbacks mentioned earlier. The main advantage of the method is that fatigue is diminished at workplace during the working process by elimination of predisposing factors at the very beginning of their action.

As far as we know, the method of electrical stimulation suggested by us remains a pioneer of the kind.

2. Methods

In the period of several years, in a number of factories in Lithuania wide electroplethysmographic, electromyographic, ergometric research has been undertaken. Over 200 women workers aged 35-55 years with work record no less than 10 years type of work have been examined.

We have been successful in overcoming industrial hypokinesia employing the electrical stimulation of muscles transcutaneously by stimulating the muscle triceps and the muscle erector spinae using the modulated low frequency and voltage alternating electric current from device "Myorhythm-021". The duration of exposure was 10 min. The course of treatment consisted of procedures in threshold regime. The stimulation by low voltage and frequency modulated alternating current device "Myorhythm-021" was being performed directly at the working place without interrupting even for a second the production process [3, 4]. The investigation has been carried out both in nonstimulated and stimulated groups before applying electromyostimulation, during EMS and after EMS.

3. Results

Research has shown that the method suggested is an effective means improving the vegetative function of the skeletal muscles of the working women (n – of persons studied – 16; n – of examinations – 108). It also arouses positive emotions and contributes strongly to lessening the feeling of fatigue, which appears during the working process. The data adduced indicate that electromyostimulation increases the arterial blood flow both in the stimulation ($19.1 \pm 6.6\%$) and post-stimulation ($15.5 \pm 10.9\%$) periods, $p < 0.05$ as compared with the control period, i.e. the pre-stimulation period.

Electromyostimulation decreases the venous haemostasia in the foot ($10.45 \pm 4.37\%$) and lower leg ($3.42 \pm 1.61\%$) in the second part of the working shift. Meanwhile the results are reverse in the non-stimulated group. There is essential difference between the two

groups (n – of persons studied – 16; n - of examinations – 108) compared, $p < 0.05$.

Electromyostimulation increase the rate of the nervous impulse ($3.35 \pm 0.81\%$). There is essential difference between the groups (n – of persons studied – 16; n – of examinations – 32) compared, $p < 0.05$.

Electromyostimulation significantly improves bioelectric activity (mA) and mechanical work (kg s) ratio in the stimulated group (4.53%).

Griunbaum test (reflected fatigue of nervous system: duration of sensomotor reaction in s)

The nonstimulated group (n – of persons studied – 121; n – of examinations – 4.840) showed an increase in the index of industrial fatigue at the end the working week (6.58%).

In the process reverse was observed in the stimulated group (n – of persons studies – 35; n – of examination – 1.400). The stimulated group showed decrease in the index of industrial fatigue at the end of working week (75.84%). There is an essential difference between the groups, $p < 0.05$.

The analysis of the data obtained from questionnaires after examining 2.522 women workers at several factories of Lithuania engaged in the same sitting type of work at assembly-line as regards the subjective influence of EMS have shown positive influence in 89.17% of cases, no tangible influence in 8.64% of cases and negative effect (difficulties in mowing and pain in the stimulated area) in 2.18% of cases.

The indisputable merit of the method suggested lies in the fact that rehabilitation by means of EMS is performed immediately after the first manifestation of fatigue directly at the working place without interrupting the process of production. The latter circumstance is of great importance for both parties engaged in production process: the worker is tempted by the possibility of earning more without getting fatigued while the employer is satisfied with a greater amount of work well done.

The determinant influence of electrostimulation on vegetative functions of the skeletal muscle during rehabilitation is obviously related with improvement of peripheral blood circulation as well increased activity of the sympathetic nervous system through augmented afferent performance.

A great advantage of the method of electrostimulation applied to overcome the fatigue is the fact that all procedures are performed at the place of work without interrupting the process of production. It might be supposed, consequently, that lessening of industrial fatigue in the workers applying the stimulation of the skeletal muscles could be a new trend in treating occupational injuries.

4. Conclusions

1. Research has shown that the method of electric stimulation is rapidly restoring vegetative performance of haemodynamic and motor functions of the skeletal muscles. It arouses positive emotions and contributes strongly to lessening the feeling of fatigue, which appears in the working process.

2. The determinant influence of electrostimulation on vegetative functions of the skeletal muscle during rehabilitation is obviously related with improvement of peripheral blood circulation as well increased activity of the sympathetic nervous system through augmented afferent performance.

3. The facts adduced above that the method of electrostimulation is a simple but efficient method reducing production fatigue without disrupting the process of production.

Lessening of industrial fatigue in the workers applying the stimulation of the skeletal muscles could be a new trend in treating occupational injuries.

References

- [1] J.Kahn (1994) Principles and practice of electrotherapy, New York, pp. 75-127.
- [2] R.Kibiša, A.Griunovas, J.Poderis at al (1986) Decreasing of industrial fatigue by means of electromyostimulation (methodical recommendations), Kaunas-Vilnius, pp. 1-8.
- [3] R.Kibiša (1993) Prevention of postoperative haemodynamic complications in the neurosurgical clinic, Kaunas, pp. 32-41.
- [4] R.Kibiša, V.Šarkinienė, I.Dūdienė et all (1996) Electromyostimulation in clinical practice, Kaunas-Vilnius, p.13.