

Investigation of Functional State of Spine and Paravertebral Tissues and Review of Assessment Methods

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Introduction

Back pain and related health disorders nowadays are important healthcare problem [1]. Back disease “becomes younger” since more young people suffer from it. Disorders of functional state of spine and balance of strength and stamina of surrounding muscles are one of the causes of back pain related health disorders [1, 2]. Back pain is the most frequent complaint of employable people. Lasting work in awkward position or in badly equipped, nonergonomic workplaces provokes headaches, neck pain, neck and shoulder pain and back pain. Increasing number of research proves relation of back pain and neck pain to smoking, obesity, depression, exercise at leisure time, poor socio-economic status, genetic factors etc. [3].

Functional disorders of spine mostly are reversible, i.e. temporary. Medical rehabilitation is necessary aiming to reduce pain and frequency of illness recurrence, to increase functional ability of the patient and quality of life, to reduce level of disability [4]. Functional disorders of spine often originate from functional block of spinal segments. Functional block may occur both in healthy spine and because of morphological changes (e.g. in osteochondrosis). Functional disorder of spinal motion segment manifests by limited movements [2].

Goniometry [5] is used to assess the functional state of spine though it only enables to measure flexibility of spine and physiological flexures. Complete examination of spinal function is used rather seldom.

The goal of the study was to carry complete examination of different groups of persons (taking exercise and having no back pain, taking exercise and complaining of back pain and patients having back pain and participating at rehabilitation programme) and review diagnostic value of methods used for assessment of functional state of spine and paravertebral tissues.

Methods

45 volunteers (22 females and 23 males) participated in the study. Their age was from 20 to 45 years. The participants were divided into 3 groups. In group 1 were included patients having back pain and performing rehabilitation programme at the Centre of Rehabilitation, Medicine of Physical Culture and Sport of the Vilnius University Hospital „Santariskiu Klinikos“. Persons having back pain and exercising for 3–4 hours per week were included in group 2. The last, control group was composed of persons exercising for 3–4 hours per week and having no complaints. All participating persons were informed about the aims and procedure of the study and signed consent to participate in the study.

Experimental analytical methods were used in the study. “The Insight Subluxation Station” (USA), a computerized equipment, goniometry, visual pain scale (pain index from 1 to 10 points) were used. “The Insight Subluxation Station” (USA) allows to evaluate integrated 5 parameters: 1) state of paravertebral muscles registering electrical activity expressed in microvolts (μV) of muscles by the method of static electromyography using surface electrodes 2) spine flexibility in cervical and lumbar region in sagittal and frontal plane expressed in degrees ($^\circ$), using wireless inclinometer; 3) influence of autonomic nervous system to functional state of paravertebral tissues by thermoscanner measuring deviations of skin temperature expressed in degrees Celsius ($^\circ\text{C}$); 4) variability of heart beat frequency at rest using pulse wave record contour and 5) pain tolerance limit of paravertebral tissues expressed in kg/cm^2 , using algometer. The computerized equipment calculated “neurospinal functional index” (NSFI), an integrated index of all 5 parameters the final result of examination evaluating in points from 0 to 100.

Results

Analysis of electromyographic results of investigated groups showed disbalance of activity of spinal muscles manifested in different groups of muscles: certain groups of muscles were overstretched the overstretching being compensated by other groups of muscles and causing back pain. Inclinometry has shown the greater spine mobility of the group exercising and having no complaints comparing with both the group of persons exercising and having pain and the group of patients. Thermoscanning did not show absolute temperature equality between both sides of spinal muscles, small variation was noted. Greater temperature differences were revealed in the spinal zones with more pronounced muscle overstretching. Pulse variability index has shown absence of balance between sympathetic and parasympathetic nervous system. Even 80% of persons examined had dominant sympathetic nervous system. Such dominance is response to stress, having too much effect in modern world. Exercising persons experiencing back pain better tolerated pain: while pressing mechanically painless area by algometer they felt discomfort at the force of $8.64 \text{ kg}/\text{cm}^2$. Discomfort was noted at the force of $5.79 \text{ kg}/\text{cm}^2$ while pressing the painful area. Less pressure caused discomfort in patients' group: force of $7.51 \text{ kg}/\text{cm}^2$ for painless area and force of $4.23 \text{ kg}/\text{cm}^2$ for painful area.

Conclusions

1. Complex evaluation of functional state of spine in different groups revealed differences in activity of spinal muscles, spine mobility, activeness of sympathetic nervous system, tolerance to pain.

2. The equipment used enabled to find causes of pain that were not discovered by other diagnostic methods, to choose more precisely a complex of rehabilitation means and to assess effectiveness of rehabilitation.

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