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Review Article

Movement pattern and muscle balance as a source of lumbar spine health according to the concept of Kinetic Control

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ABSTRACT

Introduction: Since the beginning of the 21st century rehabilitation has developed rapidly, however still many patients report problems of the musculoskeletal system.
Aim: The aim of the study was to analyse motor control of the lumbar spine according to different movement patterns and chooses the best exercise for abnormal movement patterns.
Material and methods: The lumbar spine is a region with reference to which patients most often report pain. Pain sensations are most often induced by mechanical overloads. In order to prevent such overloads and treat the pain, it is significant to assess various movement patterns.
Results: The concept of Kinetic Control allows analysing the movement patterns thoroughly, with the use of the assessment of the direction control for flexion, extension and rotation movement.
Discussion: Clinical indication is for people with symptoms and those who still have not reported the lumbar spine pain to work in order to regain correct movement timing during such a global movement. It is often advisable to work at the same time towards controlling the direction of movement, regaining optimal elasticity of multi-joint structures and restoring proper segmental stabilisation. Identifying a dysfunction of the musculoskeletal system early enough, it is possible to avoid pathologies and pain in patients, simultaneously minimising the risk of irreversible structural changes.
Conclusions: The loss of motor control is related to the low back pain, and is a good diagnostic tool. Important is the choice of motor control exercises for a particular direction of motion.

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1. Introduction

Since the beginning of the 21st century rehabilitation has developed rapidly, mainly due to advances in clinical tissue imaging (MRI, ultrasound) and a lot of research undertaken all over the world. Undoubtedly, patients with problems of the skeletal system most often complain about pain, which accompanies certain movements or activities. This is a direct message for a physiotherapist or doctor to perform a thorough movement analysis as well as correlation of conclusions made on such basis and as a result of observing accompanying symptoms. It may seem an easy task, yet a range of studies undertaken in this field shows that there is still a lot to know about movement. Everyday clinical practice is definitely facilitated by the above-mentioned progress in medicine, which provides a lot of opportunities, such as doctor's access to MRI and ultrasound examinations, thanks to which structural diagnosis is complete. Physiotherapists not only diagnose patients but also provide therapy with feedback using more often ultrasound equipment. Still in very few places there is a chance to get access to electromyography equipment (kinesiological EMG), which allows one to assess, among other parameters, muscle activity, timing and coordination. Yet, in such a situation it is even more important to rely on academic reports, which provide essential information about the muscular system. It is worth adding that over the past few years a lot of new information has been provided when it comes to anatomy (structure and function of particular muscles), motion biomechanics, kinesiology and pathology. This scientific progress is effective only when applied by ''practising physiotherapists'' working with their patients.

2. Aim

The aim of this work is to analyse motor control of the lumbar spine and chooses the best exercise for abnormal movement patterns.

3. Material and methods

The present day classification of muscle function was determined and described by Comerford and Mottram[1] in the concept of Kinetic Control. Still a dozen years ago muscles were divided into stabilising and mobilising ones, while another classification included local and global muscles. These divisions were considerably improved when the two classifications merged, enumerating now:

- local stabilisers,
- global stabilisers,
- global mobilisers.[1–3]

Local muscle stabilise the segment locally (Table 1). They are often compared to a deep cylinder,[4] which is built from such muscles as: the transversus abdominis muscle,[5–7] the multifidus muscle,[8] the diaphragm,[9,10] pelvic floor.[11–13] This muscle group is characterised by early activation independent of the performed movement, i.e., the so-called feedforward or early timing. These muscles work mostly isometrically, with no change in their length. Their specific role consists in controlling segmental translation. The training of this muscle group should constitute one of the elements of rehabilitating patients who suffer from pain of the lumbar spine (both those who are treated conservatively as well as surgically).[14]

The group of global stabilisers (Table 1) is able to generate movement but the muscles can also control it. Since these are usually single joint muscles, their task is to control rotational movement irrespectively of the applied loads (low/high). Additionally, these muscles have effect on the assumed static posture.[1–3,15]

The third group, global mobilisers (Table 1), consists of muscles, which are most superficial. They are responsible for generating force to perform a movement and for accelerating the movement concentrically. This group often becomes dominant and ''takes over'' the role of stabilisers, which in turn inhibits movement. Generating compensation, this directly contributes to disturbances in movement patterns.[1–3]

Getting to know the functions of particular muscle groups and having knowledge as to which muscles belong to which groups enable to localise precisely muscular dysfunctions (which may cause movement dysfunctions). It is an essential diagnostic stage that allows one to provide a correct diagnosis and plan rehabilitation in an appropriate way. Correct muscular balance is essential in eliminating dysfunctions within the musculoskeletal system.[16] According to the concept of Kinetic Control there are a few diagnostic levels, which are related, among other factors, to the fact that there are three

Table 1 – Functional classification of muscles.[1–3]

Local stabilisers	Global stabilisers	Global mobilisers
1. Early activation (feedforward) 2. Activation independent of the direction of movement 3. Segmental translation control 4. No or minimal change in their length during movement	1. Functional ability to: – shorten in the full inner range of movement – maintain the position isometrically – eccentrically control returning to the initial position 2. Generating force to control range of movement and limit it 3. The eccentric work is responsible for inhibiting the rotation movements 4. The activity is not constant and depends on the direction of movement	1. Generate power to perform a range of motion 2. Concentrically accelerate movement (sagittal plane generates power) 3. Absorb loads 4. Their activity depends on the plane and direction of movement