LOW BACK PAIN AND LUMBAR MUSCLE DYSFUNCTION
(筋電計を用いた腰痛および腰部の筋機能障害評価)

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Low back pain is one of the most common health problems in modern society. In clinical practice the reason for back pain is most often unknown despite of the novel imaging techniques (MRI, CT). Some of the models that help in explaining the origin of the low back pain are based on lumbar biomechanical and structural changes. In back pain free individuals biomechanics of the lumbar spine is controlled by complex central and peripheral elements, which ensure the optimal spinal loading in everyday life situations. Normal lumbar muscle function plays a crucial role in this regard. However, low back pain leads to acute and chronic impairments in paraspinal muscles and their automatic control mechanisms. Acute changes are observed as impaired control properties in paraspinal muscles. Pain in any spinal structure results for paraspinal muscle protective guarding that protect the spine from excessive / harmful loading and further injury. For same reason reflexive lumbar muscle activities (e.g. reflex latencies) are impaired. Chronic effects include more definitive changes in muscle structure and performance due to the fact that chronic low back pain patients fall into a vicious cycle of pain induced disuse and avoidance behavior. This eventually leads to deconditioning of spinal muscles (e.g. impaired strength and endurance) and other spinal structures. These functional deficiencies can be normalized by functional restoration in forms of active physical rehabilitation, which has been recently recognized as an effective treatment for chronic low back pain.

Surface electromyography (sEMG) enables an objective and accurate means to measure paraspinal muscle functions. The amplitude of the sEMG signal is linearly related to the muscle activity level and therefore it can be used in the assessment of local muscle force production. This enables measurements of lumbar muscle activities and spinal loading in, for instance, complex lifting activities. The impairments in lumbar paraspinal muscle activities in relation to low back pain can be easily assessed. One example of this is missing trunk flexion relaxation phenomenon. Normally paraspinal muscles relax in full trunk flexion, but stay active in acute low back pain. Further, the amplitude of muscle activity during extension from flexed position is diminished in low back pain patients in order to optimise the spinal loading in painful situation.

Objective local muscle fatigability measurements can be based on assessment of sEMG frequency alterations as quantified by shifts of zero crossing rate, median or mean power frequencies towards lower frequencies. Active rehabilitation programs aim on restoring impaired co-ordination, mobility, strength and endurance. Therefore lumbar mobility, back extensor muscle strength and endurance assessments have been widely used in quantifying the physical capacity outcome in active physical rehabilitation programs. Especially lumbar muscle endurance assessment has now been recognized as an important factor. Lumbar muscle endurance assessment can be objectively assessed by the measurement sEMG frequency alterations and this favours the use of sEMG in the follow-up of active physical rehabilitation.