The degeneration of the lumbar spine is strongly associated with aging, but this does not mean that pain is an unavoidable accompaniment (though the recorded incidence of low back pain suggests otherwise). Recently, more attention has been drawn to the problem of changes related to the aging of our musculoskeletal system and the associated socioeconomic implications. We now have advanced equipment to examine patients and our store of knowledge is enormous, but the application of this knowledge to a working practical plan at the individual level is problematic. Understanding the automatism of the normal function of the lumbar spine is essential for treating mechanical low back pain because the main goal is to correct this functional disorder. However, the long-term goal of treatment should be to involve patients in their back disorder management.

Key words: aging, degeneration, lumbar spine, low back pain, exercise

The Evaluation and Treatment of Low Back Pain in Older Adults

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Introduction

As life expectancies extend, the dilemma of how to manage the increasing number of people with aging-related spinal degenerative disorders has become a commonplace challenge in health care. In Europe, the proportion of people over age 65 was 19% in 1995 and is projected to grow to 30% in 2025 (the proportions over age 75 are 5% and 9%, respectively). The problem of spinal degenerative disorders encompasses not only the grave economic cost but also the lack of consensus on causes and appropriate treatments. In fact, the therapy of low back pain is tied less to treatment than it is to the practitioner’s ability to utilize endogenous physiologic properties of the human body to correct and adapt to the degenerative changes taking place during the aging process of the spine.

It is important for us to comprehend the pathophysiology, pathoanatomy, and pathomechanics of the lumbar spine in aging patients. Only then can we train the body to correct itself, as well as educate the patient in continuous care and exercise after leaving the physician’s office.

Functional Biomechanics

Lumbar stability is provided by three interrelated systems: the lumbar column (passive system), the lumbar muscles (active system), and neural control (control system). This conceptual framework aids our understanding of the roles of various spinal system components in the management of low back pain.

The spinal segment, also known as the functional spinal unit, determines to a large extent the functional biomechanics of the lumbar spine. But this passive osteo-ligamentous column can support only limited kilograms of load before buckling, so that the spinal ligaments alone cannot maintain stability under everyday loads (e.g., carrying shopping bags, raking, or picking up a chair). Hence, the compensatory action of the active muscle system is necessary for lumbar functional stability during body movements. The role of the ligaments is to act as sensory receptors for the ligamento-muscular reflexive arc (sensory-motor control), which prevents painful stress concentrations within innervated tissues (though these stresses may not be sufficient to cause physical disruptions). Excess stress concentrations are likely the catalyst for mechanical low back pain, in spite of any structural changes in the lumbar spine that may be occurring.

Degeneration of the Lumbar Spine

All tissues of the lumbar segment undergo irreversible degenerative changes as we age. Recent MRI studies have indicated that degenerative changes in lumbar discs begin as early as the second decade of life, starting at the L5 and L4 levels and proceeding to cranial lumbar levels during aging.

In the spinal segment, the disc and the facet joints interact with each other. Hence, disorders in the disc influence the biomechanics of the facet joints and vice versa. At the early stage of this process the lumbar spine can be “mechanically sensitive” due to the stiffness of the motion segment, which may result in continuous or intermittent low back pain. As more motion segments degenerate the dysfunction of the lumbar spine...
becomes more pronounced, resulting in unfavourable loads on the structures of each segment. The persistent activation of lumbar muscles is believed to provide functional stabilization in order to prevent unfavourable motions that could cause painful tissue injuries and a continuation of the pain circle.5,6

One recent study found that disc narrowing appeared to be the radiographic feature most strongly associated with back pain.7 Another study concluded that the progression of disc-space narrowing was predicted by age, back pain, and radiographic hip and knee osteoarthritis.8

Sensory-Motor Control of the Lumbar Spine

The continuous neurologic feedback from the sensory receptors of passive and active structures of the lumbar spine is a part of the proprioceptive system responsible for optimal recruitment of the paraspinal muscles. The output signals that initiate muscle action are modified by the input from the proprioceptive nerve endings. Further, mechanoreceptors play an important role in monitoring position and joint movement by regulating and modifying muscle tension. Hence, this sensory-motor control system of the lumbar spine coordinates the paraspinal muscle tension in such a manner that the forces applied to various structures are properly distributed regardless of the position of the motion segment.9

Low back pain with elevated activity of the lumbar muscles but without pathoanatomic structure changes may be produced by overstretching ligaments, resulting in the dysfunction of the lumbar spine. In the degenerative lumbar spine the sensation of pain is easier to understand: the sensory-motor control cannot maintain the normal functional stabilization of the spine, causing injuries to the motion segment.3

Diagnostic Evaluation of Low Back Pain

Low back pain may be caused in 89% of cases by mechanical factors. Red flags for mechanical causes include tumour, infection, inflammatory arthritis, visceral diseases (including diseases of the pancreas, kidney, ureter, and aortae, as well as diseases of other retroperitoneal tissues), and osteoporosis, all of which must be diagnosed and treated appropriately.11

After excluding these red flags, the important role of the clinician is to listen to the patient’s history of symptoms and to translate this information into biomechanical and degenerative muscle function and sensory-motor control data. The clinician uses medical knowledge, practical experience, and common sense to translate this information into the functional diagnoses to be tested during the patient’s physical examination.

Degeneration of the lumbar spine in patients with mechanical low back pain is easily revealed by means of imaging equipment (such as plain film radiography, MRI, or CT scanning7,8), but determining the functional diagnosis of low back pain is a more demanding task. For the patient, however, the imaging of her or his spine, especially by MRI, can be very important.12

Sarcopenia

Aging is associated with progressive loss of neuromuscular function that leads to increasing disability and loss of independence. The term sarcopenia is used to describe the loss of skeletal muscle mass and strength that occurs in concert with aging. By the seventh and eighth decades of life, maximal voluntary contractile strength is decreased on average by 40% for both women and men in proximal and distal muscles. Loss of skeletal muscle fibres secondary to decreased numbers of motor neurons appears to be the major contributing influence (Figure 1), but other factors—including decreased physical activity, altered hormonal status, decreased total caloric and protein intake, inflammatory mediators, and factors leading to altered protein synthesis—must also be considered.

The beneficial effects of a combination of continuous aerobic, high-resistance, and stretching exercise programs are well established. However, even those individuals who maintain their fitness through exercise do not appear to be immune to sarcopenia.10

Table 1: Options for Short-term Pain Treatment

<table>
<thead>
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<th>Option</th>
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<tr>
<td>Short-term bed rest several times daily to reduce disc pressure</td>
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<tr>
<td>Local warm or cold therapy for pain and relaxation of muscles</td>
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<tr>
<td>Traction by hanging from a bar to draw apart the motion segments and stretch local and global muscles</td>
</tr>
<tr>
<td>Temporary lumbosacral orthosis for reducing pain and lumbar dysfunction</td>
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<tr>
<td>Stretching exercises for improving trunk flexibility</td>
</tr>
<tr>
<td>Transcutaneous electrical nerve stimulation (TENS)</td>
</tr>
<tr>
<td>Medications for symptomatic care such as nonsteroidal anti-inflammatory drugs (NSAIDs), analgesics, muscle relaxants, and antidepressants</td>
</tr>
<tr>
<td>Physical therapy and massage coupled with exercise and education</td>
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Treatment of Low Back Pain: General Rules

The strategy for conservative management of low back pain combines intervention with education and rehabilitation. The central idea is that the patient learns to set her or his target for rehabilitation, then learns to be an active participant of the rehabilitation team.13 So, the goal of the patient is to move from treatment to active exercise.

What must be conveyed to the patient in the treatment of low back pain are the training rules. The musculoskeletal tissue of the body will strengthen through the minor trauma caused by proper exercise.
There are irreversible degenerative changes that all tissues of the motion segment undergo as we age. The continuous neurologic feedback from the sensory receptors is a part of the proprioceptive system responsible for the recruitment of paraspinal muscles. As the number of motor neurons declines with age, so does skeletal muscle mass (sarcopenia).
Pain after exercise or working is a crucial point in evaluating quantity of training. Mild soreness of muscles is a pleasant feeling during and after training or working, whereas strong soreness of muscles is an unpleasant feeling during or after training or working. Working to the point of strong soreness leaves the musculoskeletal tissues more strained, painful, and stiff. The body can tolerate this pain cycle but the body may react to the detriment of therapy. Thus, the patient should be retrained to working at the level of mild soreness. The study of physical training calls this effect delayed onset of muscle soreness (DOMS).

**Options for Pain Treatment**

Pain is often the most difficult stumbling block during exercise training. Although exercise will eventually reduce pain intensity in patients with low back pain, there are several methods for pain reduction that could be considered in the interim (Table 1).

**Exercise Treatment**

Exercise treatment has three goals: improving impaired back function; decreasing back pain symptoms; and minimizing disability by diminishing excessive fears and concerns about back pain. Several epidemiological studies have shown that good overall physical health decreases the risk of low back pain. Further, some studies have suggested that exercise has a positive influence on the recurrence rates of back pain and work absence. There is also no evidence that exercise increases the risk of additional back pain episodes or work disability. Exercise reduces back pain intensity in patients with chronic low back pain, and exercise performed in a quota-based manner (that is, the patient completes a certain quantity of exercise) may function in part as a fear-desensitizing process. In addition, exercise treatment may be as effective as psychotherapy and antidepressant medication in treating depression associated with pain syndromes.

**Core Stability Exercise**

Core stability exercise can be defined as the restoration of the neuromuscular system (sensory-motor control) to control spinal function, thus protecting the motion segment from injuries. Since pain recurrence is caused by repeated mechanical irritation of pain-sensitive structures, and that this improved control and stability would reduce mechanical irritation and lead to pain relief.

Accurate control of the lumbar spine and pelvis is dependent not only on the capacity of muscle but also on the sensory system that provides information about the status of stability, recognition of perturbation, and the development of the internal model of body dynamic. In this internal model, the central nervous system predicts the outcome of mechanical events and the interaction between the body and the environment. Accurate control is also dependent on the capacity of the motor system to plan an appropriate strategy to meet the demands of stability.

Core stability exercise is based on the training of local and global muscles. Local muscles control mainly movements of motion segments, and global muscles control large body movements. Optimal function of both systems is required to maintain spinal function. The specific intervention must be tailored to the individual patient’s presentation because a core stability exercise program can vary depending on whether the focus is on control or muscle capacity.

**Conclusion**

Low back pain is usually a benign mechanical disorder, but individual psychosocial factors may make it difficult to solve (the “red flags” discussed above are exceptions to the rule that must be effectively diagnosed and treated). The relationship of pain to the exertion of the lumbar spine is a key point that must be considered during the functional treating and training of low back pain. To perform activities of daily living we require a body that is flexible, agile, and strong. To achieve this, it is important to consider the patient as a member of the treating and training team, with the whole team working towards the same goal. The human being develops by teaching and training but this process takes time; in fact, it’s a process that can extend throughout the patient’s whole life.

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**References**