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THE IMPORTANCE OF LUMBAR STABILIZATION EXERCISES AND SELECTED EXERCISE PROGRAMS

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Exercise has become standard in the treatment of pain in the spine. The “exercise” concept can be defined by many parameters such as strength, endurance, aerobic fitness, flexibility and coordination training.⁽¹⁾

Many prospective studies have evaluated the role of aerobics for the prevention of lumbalgia for general wellbeing. Aerobic training increases endorphin levels and mechanoreceptor stimulation to provide the biomechanical stress for the acceleration of tissue healing and may be helpful by increasing the co-ordination of durability and the neuromuscular system to reduce acute pain.⁽²⁾ However, in the literature there is no certain evidence that aerobic exercise prevents an acute episode of lumbalgia or accelerates the development of healing.

Lumbalgia can lead to a decrease in activity and accompanying aerobic fitness, and this may become a serious problem in chronic and recurrent situations. It can be attributable to undesirable results such as loss of aerobic fitness as well as cardiovascular risk factors and reduced work capacity. This emphasizes the importance of aerobic exercise as a component of spine rehabilitation programs. In postoperative rehabilitation programs, especially in dynamic lumbar stabilization exercises, information is very limited. Manniche *et al*⁽³⁾ studied 96 patients who had been operated on for the first time due to lumbar disc herniation. The first group was given a six-week dynamic lumbar and abdominal exercise program, while the second group received a more a common and moderate exercise program. The exercise program was initiated in the fifth week after surgery.

At the twenty-sixth week, the work capacity and pain scores of the first group were superior to those of the second group. However, at the fifty-second week there was no significant difference between the two groups. Researchers concluded that dynamic exercise should be started as early as possible after surgery and must be continued for a long time in order to achieve better results⁽⁴⁾. Today especially in the treatment of chronic lumbalgia instead of passive methods, the use of lumbar spine methods where the patient actively participates in treatments to restore lumbar mobility by protection techniques and also teaching the patient ergonomic education programs, have become more preferable^(5,6). In the United States workers with lumbalgia in the early period are treated with physical therapy, lumbar school and other short training programs⁽⁷⁾. In one study, the return to daily life was significantly shortened with this application and the cost for the treatment of back pain was reduced by approximately 35%⁽⁸⁾. In our country consciousness-training methods on preservation programs and exercise habits for lumbar health are almost negligible. Most patients with chronic lumbalgia ignore low back pain initially, but when symptoms related to the lumbar pathology are aggravated, patients consult health centers. The exercises which must be understood and applied by the patient should be given with increasing intensity by considering the severity of the pain and practice must be taught in a practical way⁽⁹⁾. The created exercise program with the objectives below can be listed as follows:

Many studies show that strong lumbar and abdominal muscles and good physical condition help to

decrease musculoskeletal injuries at lumbar trauma. Most studies show that compared to asymptomatic individuals, patients with lumbalgia have weak back extensors and flexors⁽¹⁰⁾. In their study of over 3 thousand male workers, Lee *et al*⁽¹¹⁾ reported lumbalgia to be significantly lower in those who exercise regularly.

Exercise Programs

Exercise programs may differ depending on the purpose of exercise, as can be seen below:

Strengthening Exercises

Weakness of muscles in the lumbar region is one of the main risk factors for the development of lumbalgia. In chronic lumbalgia, muscle strength decreases. Exercises hold an important place in the conservative treatment of mechanical lumbalgia; strengthening muscles ensure an increase in endurance and pain reduction and improves posture. Normally back extensors are stronger than the flexor muscles. However in chronic lumbalgia of mechanical origin, the extensor muscles are weaker than the flexor muscles⁽¹²⁻¹⁶⁾. In patients with lumbalgia there is decrease endurance in the paraspinal muscles which increases the risk of trauma in the lumbar region when lifting heavy objects or when remaining in a static position for a long time. Accordingly, strengthening exercises are used in patients who aim to improve the situation with functional exercises⁽¹⁷⁾.

Flexion Exercises

In 1937 Williams⁽¹⁸⁾ suggested that for lumbar pain and leg pain due to compression of the intervertebral foramen nerve root, opening the foramen by flexion exercises reduced pain. McKenzie⁽¹⁹⁾ suggested that posterior overflow of nucleus of disc starting compression of the nerve and causing pain and exercise alleviate pain by providing slipping of disc. Flexion exercises reduce increased lordosis and posterior slide loading by enabling the gravity center to slide forward. Abdominal muscles show a protective effect on the spine against torsional stresses.

Hyperlordosis is the result of abdominal muscle weakness and dorsolumbar fascia contractures causing anterior pelvic tilt, especially when there is

loading on the facet joints. Therefore, the importance of flexion exercises that strengthen the abdominal muscles has an impact. Another effect is stretching the coxa flexors and lumbar extensors to allow posterior fixation of the lumbosacral junction⁽²⁰⁾.

Extension Exercises

The main task of the extensor muscles of the body is to control the body during flexion and to protect posture. Posterior pelvic tilt occurs due to thoracic or lumbar kyphosis as a result of weakness of the paraspinal extensor muscle. With extension exercises pelvic control increases and as a result of this, neuromuscular coordination becomes easier and durability increases. Normally trunk extensors are more powerful than flexors and the flexor/extensor ratio increases 1/1, 3/2. In patients with chronic lumbalgia, extensor muscle weakness and powerlessness develops rapidly and the above-mentioned ratio is reversed⁽²¹⁾. Extension exercises proprioceptively change the perception of pain by reducing neural tension. They strengthen paraspinal muscles and enable an improvement in spinal mobility and endurance. This exercise type, especially after the acute phase in the presence of herniated nucleus pulposus, obtains a regression of symptoms by centralizing the nucleus pulposus⁽¹⁶⁾.

Mobilization Exercises

Soft tissue and joint movement should be sufficient to ensure normal spine function. Length, force and durability are important in the continuation of suitable movement and function. These imbalances (hypomobility, hypermobility, or tissue shortness) will break down the movement and order compliance and so a risk factor for trauma occurs. Collagen and connective tissue are the basic structural elements. Due to the restriction of movement the elasticity of the collagen begins to harden and shrivel up. With the development of fibrous tissue, the range of motion decreases; this reduction may occur depending on an increase in muscle tone, facial thickening or shrinkage of the joint capsule. In addition, a decrease in the mobility of the spine is observed as a result of aging. Mobilization is necessary for forward bending and lifting weight. Mobilization exercises target a range of joint motion.

Mobilization solves muscle spasms and reduces pain by tension of adhesions, elongation of shortened

muscles and muscle mechanoreceptor stimulation. Intervertebral disc and facet joints are synovial structures, and mobilization is necessary for nutrition and also prevents cartilage degeneration.

Stretching Exercises

Elongation occurs by stretching of elastic fibers in the connective tissue. In addition, the Golgi tendon organ is stimulated and the agonist muscles are relaxed via the central nervous system. Stretching exercises must be applied in order to achieve optimal muscle length before strengthening the muscles and these exercises prevent structural deformities for decreased joint motion junction due to muscle, ligament and connective tissue shortening⁽²²⁾. Stretching exercises begin with low force and the force gradually increases. Studies have emphasized the necessity of exercise therapy in combination with lumbar school programs because although the short-term results of lumbar school programs are good, the long-term effectiveness is questionable. In addition, in general lumbar schools it is accepted that patients with lumbalgia or chronic lumbalgia need to be given basic training in order to avoid repetition of pain. However, considering that 60-80% of people spend a period in their lives with lumbalgia, the fact that arises is everyone's need for basic information about lumbar health. Therefore, lumbar school programs, which are accepted as a method of secondary prevention in conservative treatments, should also be provided to healthy people as a means of primary protection⁽²³⁾. Dynamic lumbar stabilization exercises have an important place in rehabilitation programs both in the prevention and operative treatment of lumbar disc herniation. These exercises must be in a neutral position that best balance the segmental forces between the disc and facet joints and using most effective axial tension force to ensure stability.

Neutral position and even lumbar stability remain intact in a during exercise and on the move. It is mentioned that exercise increases muscle strength and improper tension is avoided⁽²⁴⁾. Exercise is controversial in the treatment of acute lumbalgia. Many randomized prospective studies of acute lumbalgia have failed to show the beneficial effects of exercise on placebo treatment.

Exercise based on a dynamic assessment of the patient's initial exercise program; flexion or extension movements which centralize lumbalgia (causing less radicular pain), or on the basis of activities are ways contributing to lumbalgia⁽²⁵⁾. The aim of the rehabilitation program is to improve the functions that cannot be fulfilled due to pain as soon as possible after acute pain. Strengthening exercises have been considered as part of this process for a long time. Some prospective information is available supporting the idea that these exercises help by increasing body strength and/or durability and by protecting against the development of pain or damage. Stability of the lumbar spine is provided by bone architecture, the disk mechanics, ligament and muscle strength supports endurance and coordination. Stability control depends on active muscle contraction and any damage resulting from the structure of passive support of the spine causes a decrease in the natural stability of the spine and it should be considered that the need for effective muscle control increases. Optimal muscle strength protects the spinal motion segment from chronic repetitive shear forces and acute dynamic overload. "Spinal stabilization" is conceptually known as the fusion of muscles and exercises to improve spinal muscle function. The various abdominal, pelvic, and body muscles connect the thoracolumbar fascia; it behaves like an abdominal corset by allowing the spine to bend and rotate forward and backward. The newly introduced "core stabilization" concept allows for the examination of the spine and the kinetic chain in a wider dynamic area. Functional aspects of the lumbar muscles and the abdominal muscles are classified as "local or global stabilizers".

Local stabilizers can help to minimize rotational and shear forces through the three-joint complex by controlling lumbar posture, intervertebral stiffness and the positional relations between lumbar vertebrae.

Global stabilizers are more superficial muscles that usually control the coarse movements of the body and play a role in communicating the dominant force from the pelvic to thoracic region. Functional distinctions between these two groups have become a major focus of attention in spine rehabilitation. The inter-segmental muscles, the muscles of the spine which are firstly prone to fatigue and atrophy, act as tonic or postural stabilizers after

injury of the spine. For this reason, the first stabilization exercises are confined to the muscles that control segmental mobility. The next phase of stability training includes direct or indirect strengthening of muscle groups by various exercises for a neutral spine posture. Neutral spine is defined as the distance between the anterior and posterior pelvic tilt mid-point. In education a variety of body positions starting with lying down, standing, sitting and jumping, so as to help ensure a neutral spine position, is prepared for lumbar and pelvic exercises in order to increase movement awareness. This training, while maintaining a neutral spine with extremities exercises, and then continues with the implementation of resistance to extremities either manually or weights. These exercises which stress full pelvic control are also performed slowly to improve neuromuscular coordination and to increase endurance and strength. "Rectus abdominis" is the third phase of stability education that allows strengthening of the major muscles which provide movement such as the erector spinae and latissimus dorsi. Abdominal exercises, especially righting movements, have been a part of lumbar exercise programs for a long time. Sagittal plane standing is used as a routine for stabilization, however partial twist removing is limited only to the head and upper body. During the initial period the obliques and rectus abdominis muscles are activated; in the second half of the righting mainly the iliacus and rectus femoris muscles provide strength. Stabilization exercise is important to allow the normal lumbar motion to maximize the lower extremity muscle flexibility. Insufficient flexibility causes transmission of excessive stress on the lumbar motion segments and sacroiliac joints. Insufficient flexibility of the lower extremity has two types; hamstring, gluteus maximus and gastrocnemius-soleus muscle tension or coxa flexors, tensor fascia lata and quadricep tension. Coxa flexors and extensors have a major impact on lumbar spine positioning because of their pelvic connections. For this reason self-tensioning techniques must be taught as early as possible to ensure the active participation of the rehabilitation program. While the pelvic

position is as neutral as possible, creating tension is important because an excessive anterior or posterior pelvic tilt eliminates the benefits of flexibility exercises⁽²⁶⁾.

Dynamic Lumbar Stabilization Program

Dynamic lumbar stabilization, dynamic abdominal self-bracing, finding the neutral position and resume techniques were developed by San Francisco Spine Institute in the U.S. as shown by Saal⁽²⁷⁾ in the late 1980s. They are used to ensure the stability of the body and increase aerobic capacity. The purpose of the neutral position and stabilization is to reduce ligament, tendon and joint tension, and to ensure functional stability and balanced distribution of the load on the intervertebral discs and facet joints. This technique is applied for mechanical lumbar pain, disc herniation and post-operative rehabilitation of patients (Figure 1). A dynamic lumbar stabilization program comprises two parts; pain control and exercise training.⁽²⁸⁾

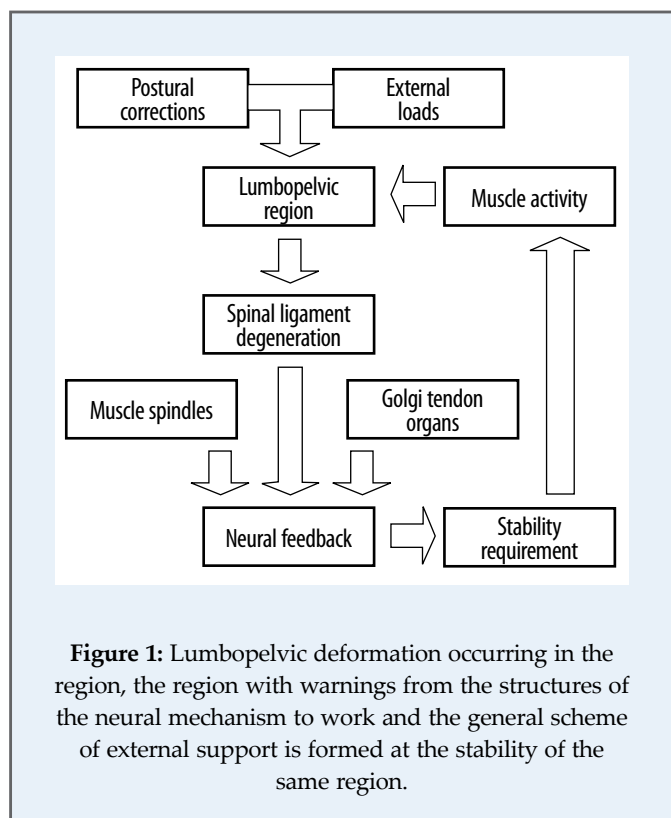


Figure 1: Lumbopelvic deformation occurring in the region, the region with warnings from the structures of the neural mechanism to work and the general scheme of external support is formed at the stability of the same region.

Pain Control

Before starting the exercise training, drug therapy to control pain, physical therapy modalities, local injections and a variety of teaching methods are applied to protect the lumbar.

Training Exercise

Initially, exercises are given to increase the mobility and flexibility of the abdominal, dorsal and lower extremities. While finding the neutral position, knees are held slightly flexed and weight is evenly distributed on both feet. Using the abdominal muscles, the pelvis is driven by rolling back and forth and a comfortable and pain-free position is found by increasing or decreasing lumbar lordosis. In this case, abdominal muscles feel tense and there is lumbar circumference bracing. Then, lying on his back, the knees and hands go forward, in order to build a bridge and the neutral position is taught with the abdominal muscles self-bracing while standing.

There are a series of exercise programs which aim to improve coordination and that are also used to strengthen the muscles of the upper and lower extremities. After completion of this exercise program, more advanced weight-lifting training begins. After bracing the neutral position with a single weight or weight lift stations, the abdominal muscles as well as the lower abdominal and dorsal region and the ever-increasing density of the upper extremities are executed. Intensive walking, swimming, and stationary activities such as cycling and running can be added to the program to increase cardiovascular endurance. The effectiveness of dynamic lumbar disc herniation stabilization program and uncontrolled studies performed in patients with radiculopathy has been reported to be a ratio of rotation to daily life of about 90%.⁽²⁸⁾

As a result of this effectiveness which has been shown in patients with chronic lumbalgia abdominal and back muscles, strength, flexibility and endurance and improving the physical compliance with exercises aimed at improving the control of pain given the increasing density should start and should be continued.

Core Stabilization

Despite the presence of existing disorders, it should aim to bring the best level of rehabilitation function.

This is an especially accurate step for the rehabilitation of the spine. Rehabilitation of the spine with spinal stabilization; specific tasks or ensuring the achievement of necessary movements in individuals' lives, and postures forces and speeds up simulation through function-based training. Education must integrate the concepts of dynamic stability and the specificity of function into this approach. An accepted definition of the "core stabilization" concept is currently unavailable in the literature. This concept means to gain condition especially for the use of the pelvic and coxa belt, lumbar spine, abdomen, cervicothoracic area and periscapular muscles, the trunk and extremities in order to carry out dynamic and progressive duties in private (Figure 2).

Although it is known that in patients suffering from lumbalgia, positioning of neutral spine has an important role the fact that is most of them fail neutral spine position at their daily works effectively. Any physical work that must be applied which describes the performance of one of the best uses of the rehabilitation program is required to meet the needs of that individual and should include specific movement patterns and functional training. An important role is played by the muscles of the body in terms of stabilizing the body or not moving the lower extremities and upper extremities. The muscles also force the transmission of the appropriate extremities in order to achieve particular positions. Core stability insufficiency may show itself as well as lumbalgia, depending on the model of kinetic chain function affecting the extremities which may also lead to problems. Scapulothoracic dysfunction which is a factor causing shoulder pain and lumbopelvic dysfunction of major trochanteric bursitis, patellofemoral syndrome and even pain in the shoulder, can be given as an example.⁽²⁹⁾ Core stability training is a special activity consisting of trunk stabilization exercises early on based on a variety of dynamic and multi-plane movement towards principles and skills training. The goal is ultimately for the patients to maintain proper body position and control so they can do their best to the daily works thus, reducing the risk of re-injury. Core failure, a factor that leads to a lot of situations including lumbar injuries, may be included in the "core stability" concept used in the rehabilitation of a number of different problems⁽³⁰⁻³¹⁾. Dynamic lumbar stabilization (DLS) exercises focus on disc, facet joints, repetitive trauma to damaged lumbar motion segments and to

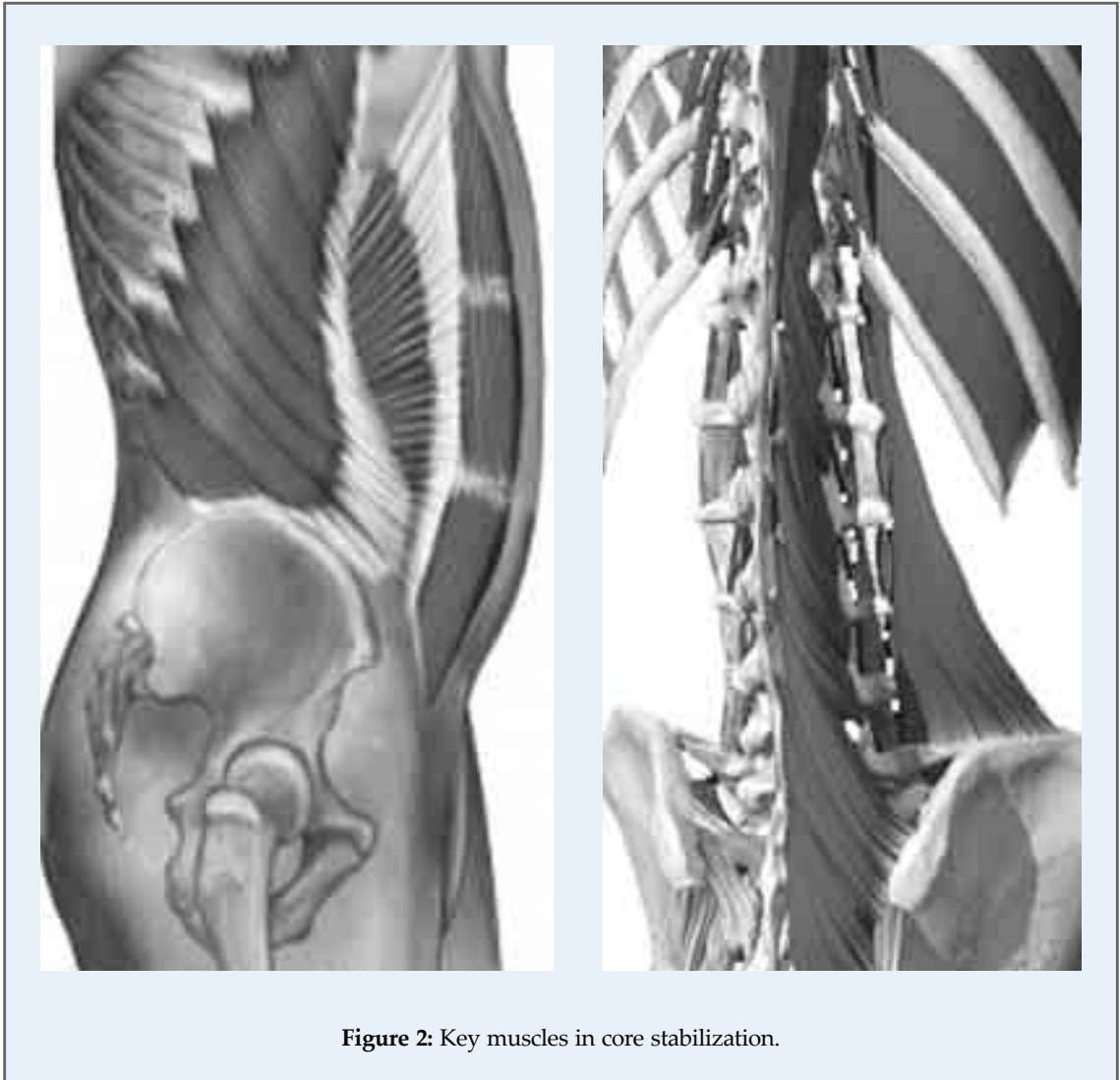


Figure 2: Key muscles in core stabilization.

prevent them from becoming a full protrusion with a simple annular tear. Annular fibers torsional strain traumas lead to fiber relaxation which leads to tears. DLS exercises can prevent micro trauma by the effect of causing degenerative changes of repetitive flexion and torsional stresses by creating a fusion of muscle, and prolapses can also be prevented that damaged annular fibers harder and harder. Muscle fusion in dynamic lumbar stabilization, medium ligament of the midline and using thoracolumbar fascia by contraction of the abdominal muscles all show the effect of a corset to the lumbar spine⁽³²⁾. This is initially enabled by the presence of the pelvic neutral position. Another objective of this exercise is lordosis control, with the increase in axial rotation the angles of lordosis may be lessened and lordosis can

be controlled, so that overloading of the facet joints can also be prevented⁽³²⁾.

Another group of exercises categorized within dynamic lumbar stabilization exercises is aerobic exercises. Decrease in aerobic capacity is important in repeating of lumbalgia. Aerobic exercises increase functional capacity, reduce anxiety and accelerate the return to everyday life⁽³³⁾. When working with a wide range of muscle groups, peripheral muscle resistance decreases, and there are increases in the endorphin level in the peripheral as well as the central nervous system which lead to relaxation and “a wave activity”. The body and leg muscles are strengthened and more resistant to Type II B fibers, which can transform into Type Ia fibers.^(12,34)

There are some rules that should be considered during the implementation of aerobic exercise. These rules include the following; exercise three days a week, 30 minutes a day, the introduction of exercise is low-density (220-age), and covers 60% of the calculated target heart rate monitoring. Exercises include a warm-up and cool-down period and movements which force excessive lumbar flexion should be avoided.⁽²²⁾ Today, the other method of treatment of chronic and mechanical lumbalgia is the “functional rehabilitation program”. This can be applied at every step of disc hernia treatment, for conservative treatment, and for patients who have undergone surgery for postoperative and failed lumbar surgery syndrome. In this treatment approach chronic pain, low correlation of pain-organ disorder (pathology), pain-disability, and disability-failure may be taken into account.

In a lumbar program lumbar whole body restoration is also essential and neglecting to attempt to correct deficiencies will increase pain⁽³²⁾. The steps of this program are summarized as follows:

Quantifying Physical Capacity

Body flexibility is measured in inclinometrically.⁽³⁵⁾ Power can be detected by isokinetic, isometric and isoinertial methods. It has been determined that with chronic pain lifting capacity is also decreased so this capacity is evaluated by the PILE method.⁽³⁶⁾ A cardiovascular isokinetic ergometer is used in the determination of resistance⁽³⁷⁾.

Reactivation to Increase Compliance and Functional Unit Re-Conditioning In Physical Damage

At the beginning of this eight-week program patients have measurements and evaluations. Later, the physical therapy specialist control is initiated in groups of eight three-phase rehabilitation programs. The first phase is applied for a period of two weeks, consisting of 1 hour 45 minutes stretching, weight lifting and cardiovascular endurance exercises three times a week. During this period pain may increase. The second phase aims to increase flexibility, trunk extensor strength and lifting capacity. This phase consists of three sessions a week of 2 hours and 45 minutes of aerobic exercises including a light load. This

period lasts five to six weeks. In the last phase, the measurements are repeated.

For continuation of the program home programs are recommended and information is given about risk factors and lumbar protection training.

To ensure the continuity of the program patients are checked at regular intervals.

Behavior Therapy and Psychosocial Evaluation of Disorders

After discectomy cases, one week, one month, two months and one year after computed tomography (CT) tests there was no association between anatomic abnormalities and continued leg pain. The many findings similar to this make us think that with chronic lumbalgia there is a complex communication between anatomical disorder, physical impairment and psychosocial factors. Inhibition in patients with the fear that the pain will increase may cause an inability to measure of pain objectively so pain behaviour cannot be evaluated. Pain behavior (“nociception”) response is affected by anxiety, cultural heritage, family attitudes and environmental effects. Fordyce⁽³⁸⁾ suggests that pain behavior is an answer which is a learned response called “operant conditioning”. If a patient in pain expresses this and someone else does his work and takes on his responsibilities, this is defined as “positive boosters”. Pain behavior decreases spontaneously in the absence of a positive booster. For this reason, patients should be encouraged to verbalize if pain is increased in exercise and patients who exercise frequently must be rewarded⁽³⁷⁾. In the final stage, called “work hardening”, a business environment simulation with re-employment training exercises is performed. Patients must be saved from drug addiction in each period. In short, today, disc herniation affects an increasing number of people which is increasing the place of conservative treatment. Not only to correct the symptoms, at patients’ who is aimed to fix the functions, must be encouraged the active participation of medical approaches to treatment for physical and mental evaluated as a whole.

To increase surgical success and in order to reduce the rate of failed lumbar surgery syndrome, a multidisciplinary approach with an intensive exercise program plays an important role in cases requiring surgical intervention.

Phases of Rehabilitation after Lumbar Surgery

Training

- Teaching lumbar protection principles, and if possible, prior to surgery or 1 day after surgery,
- Teaching proper posture and pelvic tilt exercises, pre-operative 3. day,
- Strengthening lumbar and abdominal muscles,
- Proper posture to reduce the load on the prosthesis and starting pelvic tilt and exercises after 3 weeks,
- Starting to swim after 4 weeks,
- Prohibition of too much forward bending and heavy abdominal exercises 6 weeks after surgery,
- Prohibition of rotation of the lumbar area for the first 6 weeks after surgery,
- Start jogging after 6 weeks,
- Starting (“supine”) exercises after the sixth week of dynamic lumbar stabilization,
- Don’t do team sports for three months.

Choosing an Exercise Program

- Core stabilization
- Dynamic lumbar stabilization
- Abdominal hollowing
- Abdominal self-bracing⁽³⁹⁾

Where is the Core Found?

The core is a region at the lumbopelvic-coxa junction and is the center of gravity. Due to the active “core” stabilization; there is normal length-tension relations with the coxas, normal force couples, optimum arthrokinematics and during movement the whole kinetic chain works effectively. In addition, acceleration, deceleration, dynamic stabilization and the movement of the xtremities are ensured by proximal stability.

Core Stabilization

Core stabilization is carried out in order to teach body muscles to control the spine during dynamic movements.

Included in the muscles of the body are as follows:

- Deep trunk muscles
- Multifidus
- Transversus abdominis
- Internal oblique
- Paraspinal muscles
- Pelvic base muscles

Multifidus

Paravertebral muscles in the lumbar spine lie from the lateral to the medial iliocostalis, longissimus and multifidus. The iliocostalis and longissimus originate from the iliac crest and thoracolumbar fascia, just a few branches of the longissimus stick up through the lumbar vertebrae to the medial. The multifidus is divided into five bands and each band sticks into the lumbar spine vertebrae. The distal attachment is in the areas where the sacrum, SI (sacroiliac) ligament, thoracolumbar fascia and iliac crest are. In the section that sticks in the thoracolumbar fascia, the multifidus separates from the gluteus maximus. This section limps ahead of the sacroiliac joint at the anterior and becomes a part of the thoracolumbar fascia at the posterior. Multifidus sub-extensions through the bottom of the long dorsal SI ligament make compounds with the sacrotuberosus ligament. In summary, the multifidus establishes a connection with the support sacroiliac joint ligament⁽⁴¹⁾. Multifidus fibers are localized in the vertical plane and allow very few movement in the horizontal plane. Thus, the multifidus fibers are an important lumbar spine extensor in sagittal plane movements. In horizontal plane movement few, long fibers pass through multiple segments so that would be a good stabilizer. The thoracolumbar fascia applies a pressure effect on the SI sacroiliac ligament and the ligament on the sacrotuberosus itself which is called a “self-bracing” mechanism. Multifidus muscles, which are an important lumbar extensor, along with lumbar stabilizer and the pelvis, perform important tasks on the self-bracing mechanism and the upper part of the body and the lower part of the body transfer loads. In this way, standing, sitting, walking, body movements and load-bearing function assume important roles.

Structural Disorder of the Multifidus

Histochemical changes and muscle atrophy occur due to fatty degeneration, aging, idiopathic scoliosis, and lumbar disc herniation.

During lumbalgia the following changes occur at the multifidus (Figure 3):

- Selective muscle atrophy (unilateral atrophy real time / USG) is shown as unilateral atrophy and is described by reflex inhibition. Other muscles do the tasks of the multifidus so this increases atrophy further (Hides, 1994).
- Unlike disuse atrophy, the spine and coxa erector flexors are seen to be normal. Therefore, while trying to stabilize the lumbopelvic region, particular attention should be given to the multifidus.

Abdominis Transversus (TA)

- It is one of the most important stabilizing muscles of the spine.
- Specific rehabilitation of transversus abdominis (TA) reduces lumbalgia (O'Sullivan, 1997, Shaughnessy & Caulfield, 2004).



Figure 3: The changes that occur at multifidus during lumbalgia.

- Transversus abdominis muscle contractions form an axial platform where the upper and lower extremities can move with sling systems by performing spinal stabilization (42).
- Electroneuromyography (EMG) studies have shown that the TA contracts before movement of the body and extremities (Hodges Richardson, 1998).

Objectives of Exercise Programs

The purpose of exercise programs should be to run multiple muscle groups and the motor samples by way of anatomical connections between strap muscles (43). In addition, the isolated specific muscle groups and coxa junction, spine and shoulder junction are operated together. There are three main fascia systems; the thoracolumbar fascia, fascia lata and abdominal fascia (Figure 4).

Thoracolumbar Fascia: Self-Bracing

SIE ligaments and the capsule of the lumbar spine comprise the thoracolumbar fascia anterior. The thoracolumbar fascia (TLF) and lumbosacral ligaments are the connecting region of the prime mover and stabilizer muscles of the spine (44). Activation of these muscles stabilizes the lumbosacral spine by firming support of connective tissue. This contributes to the mechanism which is called "self-bracing" (Snijders, 1993) (Figure 5).

Self-Bracing (Vleeming, 1995)

The latissimus dorsi muscle, the gluteus maximus and the thoracolumbar fascia associate with the superolateral and inferolateral posterior layers. TLF increases both contralateral and ipsilateral muscle tension. The TLF is connected to either the lumbar vertebrae or sacroiliac joint. These two-muscle contractions are important for lumbar stabilization. The transversus abdominis (TA) and internal oblique (IO) connect with medium-TLF strongly and almost directly pull the lumbar transverse process. Thus, the transverse and frontal lumbar spine planes are stabilized by the TLF (45). Abdominal mechanism is associated with both the shoulder junction and rectus abdominis.

Fascia Lata

Fascia lata muscle groups acting in the system are the gluteus maximus, tensor fascia lata, quadriceps, hamstring, and adductors (Figure 6). The fascia lata is a primary distal connection of the gluteus maximus for transition to the lower extremity from the pelvis.

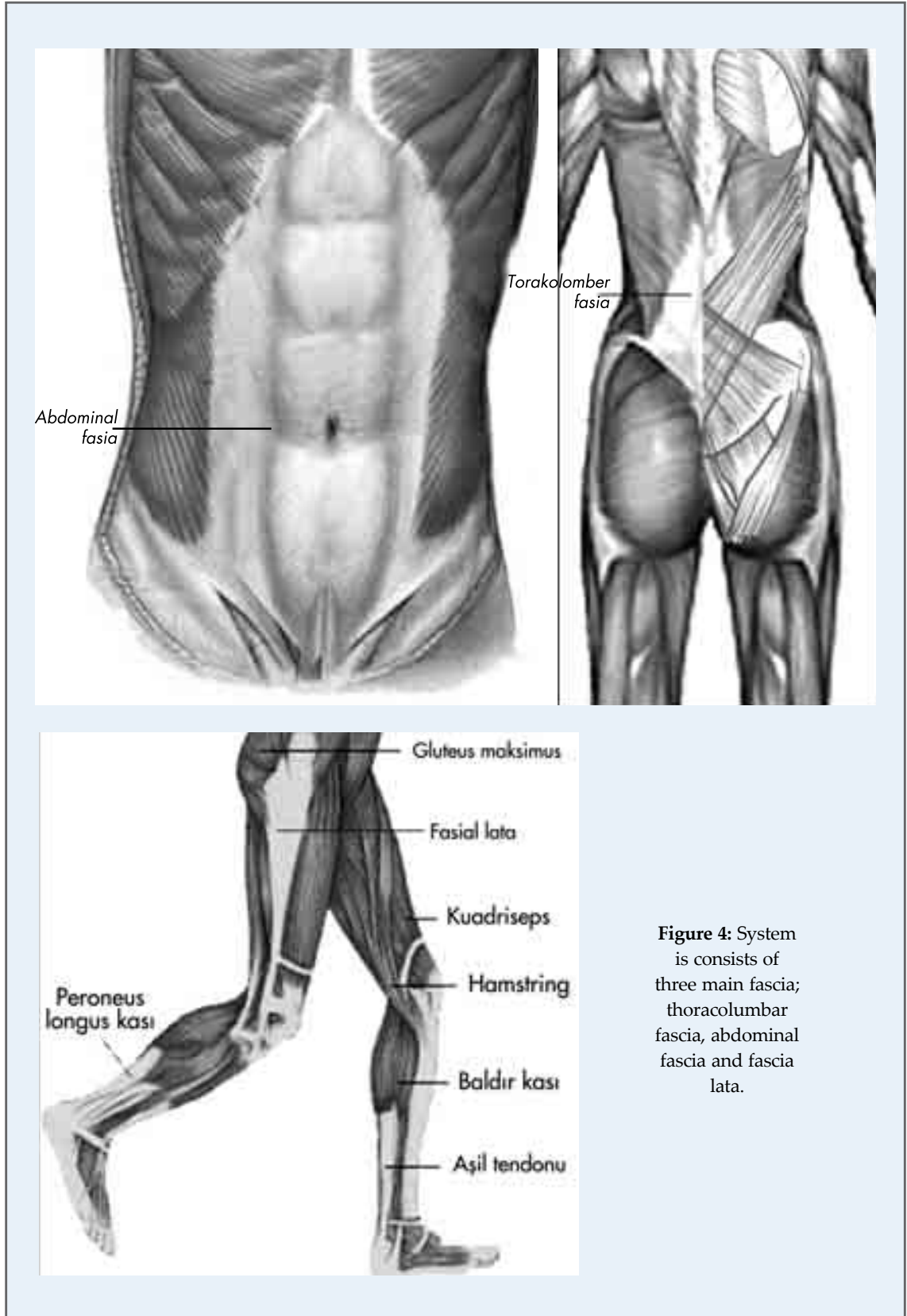


Figure 4: System is consists of three main fascia; thoracolumbar fascia, abdominal fascia and fascia lata.

The lumbopelvic region is a very important strap muscle because both fascia systems surround the large muscle groups. The thoracolumbar fascia surrounds the multifidus and erector spinae while the fascia lata surrounds the quadriceps, hamstring and

adductors. For this reason, exercises for the gluteus maximus, quadriceps and hamstring is important in lumbalgia(46). Tension in the fascia lata increases in two ways; outside pulling of the gluteus maximus and inside pushing of the quadriceps. Increasing stiffness in the fascia lata is quite important for lumbopelvic mechanism because the gluteus maximus controls the pelvis by TLF connections. Contraction of quadriceps during standing increases fascia lata tension and this stimulates the gluteus maximus on the femur, which increases pelvic extension and stimulates the TLF.

Abdominal Fascia System (Anterior Sling System)

Abdominal muscles have great importance in the stabilization of the lumbar spine and pelvis (47) (Figure 7). In the abdominal fascia system there are;

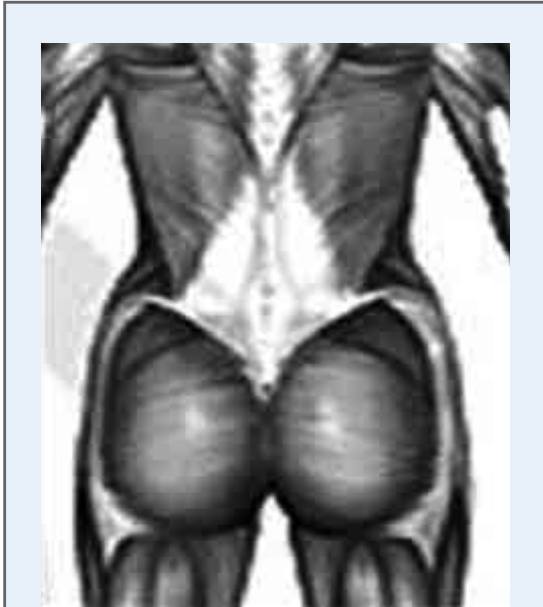


Figure 5: The muscle groups that move in the thoracolumbar fascia.

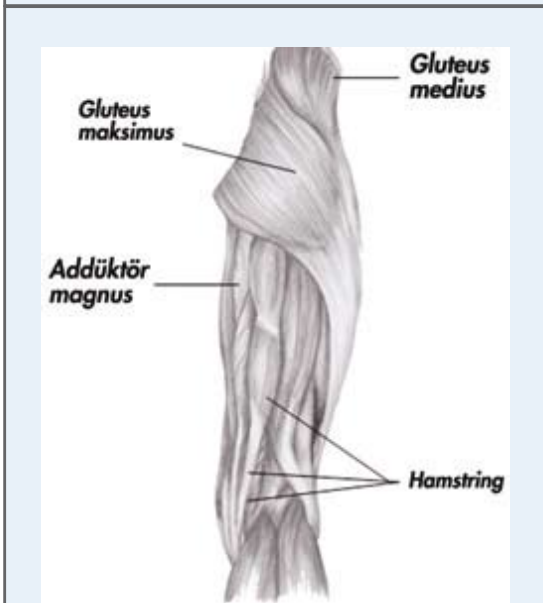


Figure 6: Leg muscles in fascia lata.

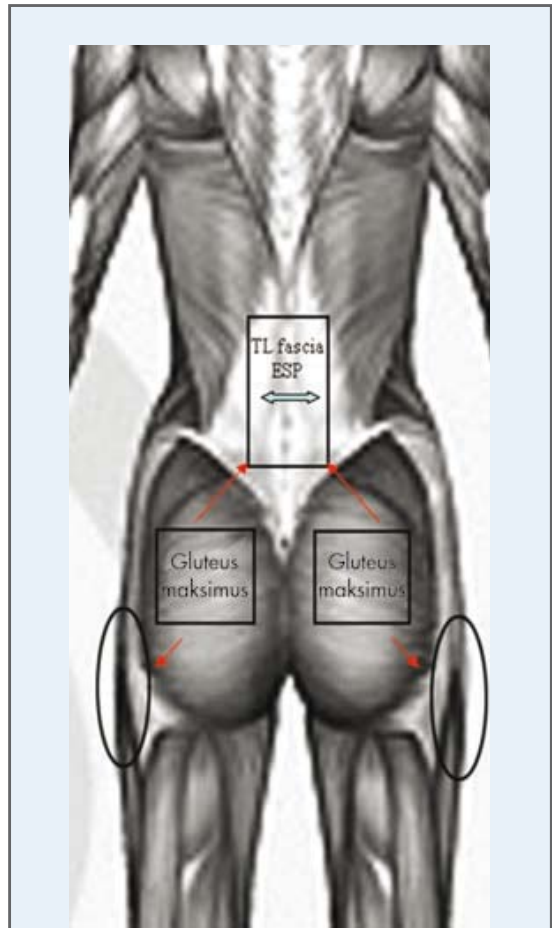


Figure 7: Abdominal fascia system

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In Figure 7 the abdominal fascia connected with the pectoralis major and the serratus anterior connected with the external oblique is shown. Furthermore, abdominal muscle resistance is impaired in the presence of shoulder junction abdominal mechanism, pelvic strap and lumbalgia.

Self-bracing (Vleeming, 1995):

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- This arrangement of the muscles and fascia enables the transfer of energy by enabling movement passage from the upper extremities to the lower extremities through the spine (Figure 8).
- The extremities and back muscles are connected to each other by the thoracolumbar fascia.

Thus, movement of the arm helps the movement of the lower extremity and trunk rotation while walking.



Figure 8: Muscles and fascia lay out, to provide passage of the movement to the lower extremities that began at upper extremity through spine by allowing the transfer of energy.

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