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Exercises in Low Back Pain

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1. Introduction

It is commonly believed that physical exercise plays an important role in the treatment of patients with low back pain (LBP) (Alaranta et al., Bendix et al., 1998; 1994**;** Halldin et al., 2005; Hicks et al., 2005; Hurwitz et al., 2005; Koopman et al., 2004). A serious problem for LBP sufferers is considerable limitation in the range of movement of the trunk and pelvis, often accompanied by shortening of the hamstring tendons and limitation of flexion or extension in the coxofemoral joint. Appropriate dosing of physiological exercise not only improves the condition of soft tissues, but also provides for proper stretching of collagen fibres and enhances the nutrition status of articular cartilage. It is important to prescribe customized programmes of exercises which restore and preserve normal activity of the lumbar spine. An appropriate exercise programme ensures the development of a 'muscle corset' of postural muscles which optimises load on intervertebral discs and passive stabilizers of the spine (ligaments, capsules). Programmes should include stretching as well as endurance- and strength-building exercises. The principle to follow is that movements in joints should be performed within painless limits. Of importance during exercise is appropriate mobility of the lumbar spine–pelvis–lower limb complex. It is often necessary to stretch the hip joint flexors and lumbar extensors as well as to strengthen weak and stretched abdominal and gluteal muscles with the aim of eliminating excessive forward tilt of the pelvis and preventing overload in the lumbar segment as well as ensuring an even distribution of load.

The key to improvement is exercise of spinal muscles to enhance segmental stability, which is compromised by degenerative processes in the disc. Regular physical exercise reduces pain and the accompanying symptoms of depression. Reduction in pain is associated with identifying the most comfortable, 'neutral' position and the ability to assume and maintain that position during motor acts.

Numerous reports emphasise that abdominal muscles are the key to achieving optimal spinal performance (Alaranta et al., 1994; Axler et al., 1997). An essential activity serving to ensure proper spinal function is controlling the posture and position of the spine during movements so that pain is avoided and the range of movement is as close to normal as possible. The above goals are achieved by ensuring appropriate daily posture, including

proper lordotic curvature of the spine. Strong muscles of the abdominal wall are essential as they prevent hyperlordosis and excessive forward tilt of the pelvis. It is necessary to simultaneously stretch the iliopsoas muscles, which are usually contractured from working conditions. At the same time, stretching exercises should be included in the exercise programme to restore the proper position of the spine.

Regular exercise is necessary for surgically managed patients. Early on following intervertebral disc surgery, exercises are mostly concerned with static motor activity and particular attention is paid to pain relief. The exercises aim to improve body posture by strengthening postural muscles, while simultaneously avoiding excessive mobilization of lumbar segments of the spine. In order to reduce pain and structural overload of lumbar segments, water exercises are recommended in small doses. It is believed that, by activating plasminogen, physical exercise may reduce the risk of development of periradicular scars (Szymanski et al., 1994).

While injury to the intervertebral disc and the resultant low back pain may be due to a variety of causes, the most important of them are believed to include: a stressful lifestyle, incorrect posture, failure to exercise regularly, and physical injury or disease (Biering-Sørensen & Thomsen, 1986). The mechanism of stress-induced BP includes increased tone of the spinal muscles. Good posture depends on adequate flexibility of the hamstring tendons, hip flexors and extensors, and extensor and flexor muscles of the spine, allowing maintenance of proper spinal caurvatures, which is of importance for appropriate loading and function of the spine.

2. Exercises in the acute and subacute phase

The literature brings conflicting data on the efficacy of exercises to strengthen muscles in the treatment of acute low back pain (Davies et al., 1979; Mitchell & Carmen, 1990; Saal**,** 1990). Some of the inconsistencies stem from methodological shortcomings, randomisation problems or the lack of precise diagnoses in most of these studies (Donchin et al., 1990). In such papers, the advantages of bending exercises in the treatment of various lumbosacral pain syndromes are compared with those of extension exercises. In one study, bending exercises were shown to be useful in patients with pathologies of the posterior segment, such as spondylolysis or spondylolisthesis (Donchin et al., 1990), while other studies demonstrated efficacy of a programme of extension exercises in patients with low back pain of discopathic origin (Delitto et al., 1993; Stankovic & Johnell)**.** The use of unidirectional exercises (only bends or extensions) is principally therapeutic oversimplification, considering the multiplicity of pathophysiological abnormalities found in patients with acute or recurrent low back pain. McKenzie's exercise programme for patients with intervertebral disc pathology concentrates on centralisation of pain rather than on the movements of bending or extending the spine (McKenzie, 1972). However, this programme is introduced only when the positions associated with pain centralisation have been identified **(**Donelson et al., 1990). Therapeutic exercise is incorporated in more complex rehabilitation programmes. Techniques enabling stabilisation of the lumbar spine in motion can be applied simultaneously to ensure dynamic muscle control and protection against biomechanical loads, such as tensing, compression, twisting and shearing action. Spinal stabilisation involves synergistic activation or co-activation of the trunk and spinal muscles in the middle segment of their range of motion. Loads are increased by movements of the

lower and upper limbs in various planes during therapy and, later, during work and everyday activity. The general objectives of such rehabilitation programmes are the alleviation of pain, development of the protective muscular "corset" of the trunk and spine and reduction of the load on intervertebral discs and other elements acting as static stabilisers of the spine (Saal**, (**1990; Tulder et al., 1997). Therapeutic sessions should be carried out in an active manner and repeated only as many times as is necessary for the patient to understand the idea behind the programme and master the exercise technique for later unsupervised practice at home. The programme should also involve instructions for the patient, who should be advised to maintain a neutral spinal position and dynamic muscular "corset" action during all daily activities associated with work and recreation. If no improvement is noted following six therapeutic sessions, the patient should be re-evaluated and the rehabilitation specialist consulted. The efficacy of such comprehensive rehabilitation programmes is well-documented and they are widely used in the treatment of professional athletes (Davies et al., 1979; Delitto et al., 1993; Stankovic et al., 1990).

In acute and subacute low back pain, kinesiotherapy should start with a set of exercises selected individually for the specific patient. Following an evaluation of the patient's exercise capacity, the type of exercises is selected together with starting positions. A comprehensive clinical evaluation serves to identify muscle groups in need of strengthening and those likely to benefit from a relaxing action. Motor re-education of the spine and the musculoligamentous apparatus is necessary. An evaluation of spinal mobility identifies hyper- and hypomobile segments. The therapeutic objective of working with hypermobile segments is to effect their stabilisation, while locked, hypomobile areas must undergo motor mobilisation in order to attain maximum motor harmony. Kinesiotherapy is usually preceded by appropriate physical therapy and followed by relaxation-inducing procedures. The exercise programme emphasises strengthening the abdominal muscles and the quadratus lumborum with simultaneous abolition of the lumbar lordosis. Attention is also given to strengthening the crural muscles, hip extensors and gluteal muscles. The application of traction along the spinal axis may be beneficial. To this end, chair traction can be applied in Perschl position, gravitational traction, or pulsed traction. The duration of a session is from several minutes to half an hour. Traction relaxes back muscles and broadens intervertebral spaces (Beurskens et al., 1997).

Exercises are applied in three basic starting positions:

- supine position with limbs flexed at the knees and hips,
- squatting position,
- lateral recumbent position.

The choice of a particular starting position is patient-specific.

Early on, exercises with the patient being hung from pulleys are also possible. When the pain has abated, exercises performed against greater resistance can be introduced, as well as group exercises and further instruction on exercises to be performed by the patient without supervision or assistance.

The exercises must not produce or intensify pain. Exercises should be selected so that it is possible to mobilise all joint-muscle-ligament systems that influence spinal function and health.

3. Exercises in the chronic phase

When the symptoms have become chronic, patients practise in small therapeutic groups. Continuous supervision by the physiotherapist is mandatory. An important component of the programme is patient education regarding optimal working conditions during both professional duties and household chores. Lasting good treatment outcomes depend on the patient exercising regularly in the home.

The treatment of back pain is extremely difficult and prolonged. We need to convince the patient that perseverance in systematic kinesiotherapy and maintaining a healthy life style is a must. Low back pain may recur, existing symptoms may exacerbate and new symptoms may develop.

Various criteria are in use for classifying patients as chronic low back pain sufferers. A temporal criterion can be used (symptoms have been present for more than 6 months) or a symptom-based one (despite back pain, the patient is able to carry on daily activity, including professional duties, be it with some limitations from time to time). Rehabilitation programmes for chronic back pain sufferers are also administered to patients after spinal surgery. Chronic low back pain is characterized by lower pain intensity, a constant level of spinal dysfunction and the presence of permanent neurological deficits. In the chronic low back pain phase, patients often appear depressed and anxious. These are important factors affecting patient motivation to carry out therapeutic exercises. Kinesiotherapy in the chronic phase is based on similar principles as treatment in the acute phase. Differences concern the pace of exercises, loads and exercise types. After exercising individually, the patients can soon join a therapeutic group performing group exercises. Individual exercises should be available to patients following spinal surgery or early on during a symptomatic exacerbation. In patients after spinal surgery, the decision to commence kinesiotherapy must be preceded by collecting detailed information about the operative procedure and the presence of any contraindications to rehabilitation.

Exercises to strengthen weakened phasic muscles are introduced when contractured muscles have been relaxed. An effective way to relax contractured postural muscles is to apply post-isometric muscle relaxation. This technique demands co-operation of the therapist and patient, who contributes to the technique of relaxation. The therapist achieves mild extension of the contractured muscle. The patient uses a minimum force to tense the muscle against the resistance afforded by the therapist's hand for approximately 10 seconds. This is followed by a muscle relaxation phase, lasting 2-3 seconds. As resistance subsides, the therapist gently extends the contractured muscle over several seconds. This cycle should be repeated a few times for each contractured muscle. Exercises associated with uncontrolled extension of passive vertebral stabilisers (ligaments, joint capsules) should be avoided as this may impair spinal stability.

Abdominal muscles are to be strengthened mainly via isometric contractions. Isotonic exercises should only be performed in the supine position. Exercises should be simple and easy to learn and carry out. Exercise intensity should match the patient's capabilities at a given time. The move from less demanding to more strenuous exercises should be gradual.

The DBC method (Documentation Based Care) is a form of kinesiotherapy based on mechanotherapy. It is an active therapy for subacute and chronic spinal ailments. The name emphasizes its documentation-based rationale. The approach to evaluating and analysing

treatment outcomes is compatible with the principles of evidence-based medicine. The method is based on modern technology and therapeutic exercise to produce the best possible functional and analgesic effect. Treatment programmes are individualised. The equipment used in DBC has been designed to enable spinal therapy with repeated dynamic loading. The aim of the programme is to restore segmental spinal motion, improve neuromuscular control of these movements, increase mobility and improve muscle exercise capacity. Free and assisted exercises are applied. The exercise technique contributes to muscular relaxation and relaxes the tensed spinal burso-ligamentous structures. Exercises involve controlled flexion in the sagittal plane, extension, rotation and flexion, and spinal rotation and retraction. Supplementary exercises include general toning and relaxing exercises and exercises to strengthen the muscle groups that

3.1 Manipulation and mobilisation

Manipulation has been recognised as an effective method in acute low back pain. However, even though some studies have demonstrated the effectiveness of soft tissue manipulation and mobilisation in the treatment of acute low back pain, other studies have not confirmed this effect (Anderson et al., 1972; Koes et al., 1996; Shekelle et al., 1992**;** Tulder **et** al., 1997). Contemporary reports are not reliable due to methodological and procedural shortcomings and the use of poorly measurable parameters for evaluating treatment outcomes. Manipulation should initially be applied once weekly in conjunction with physical exercises. Additionally, supplementary exercises for muscles may be applied two or three times a week. Regular scheduled follow-up visits are necessary to monitor changes in symptoms or signs. The treatment needs to have clear objectives. If there is no improvement after 3-4 sessions, manipulation should be discontinued and the patient re-assessed. Manual techniques should be included in initial treatment of acute low back pain to facilitate physical exercises requiring the patient's active participation. Physicians should be aware of contraindications to manipulation, especially that performed under general anaesthesia, which is associated with considerable risk. While patients undergoing manipulation are very much satisfied with this technique, there is no rationale for performing manipulation after acute pain has subsided.

3.2 Posture

An erect posture is the body's position when standing at ease. Posture changes during life under the influence of the external and internal environment. Serious postural deterioration is usually noted in the fourth decade of life, when the spinal curvatures become more accentuated. This is due to a number of factors: slowly progressive loss of muscle bulk of the abdominal muscles and extensors spinae, gaining weight and degeneration of intervertebral discs.

The lumbar intervertebral discs change with the posture in motion and inactivity. Posture determines the intensity and extent of mechanical tensing of intervertebral discs. Compressive forces acting on the lower lumbar discs decrease nearly to nil in the recumbent position, to increase rapidly in the sitting or standing position. The highest rate of increase in disc compression is associated with physical exertion, especially combined with carrying weights in an inappropriate manner. The intensity of compression depends on the force of gravity and the type and character of the movement being performed. Posture, or the

alignment of vertebral bodies against each other and the alignment of the spine along the vertical axis, is of considerable importance for the prevention of back pain.

In the standing position, body mass is distributed equally between vertebral bodies and intervertebral discs. If the spine deviates from the vertical plane, a system of levers begins to operate which increases the pressure acting on intervertebral discs several times. The increase in intervertebral disc compression is the result of the lever action and changes in the plane of action of the levers. The compressive forces do not act on the discs and vertebral bodies at a right angle, but at an acute angle. Shearing forces arise and attempt to dislocate the vertebrae. These shearing forces are counteracted by the intervertebral discs, ligaments, articular processes, and muscles that stabilize the spine.

Changes in vertebral alignment during movement of the spine predominantly affect the annulus fibrosus of the intervertebral disc. Forward and lateral bends, straightening, rotations, or any combinations of these movements, stretch and tense annulus fibrosus fibres. The degree of tensing depends on the amplitude of the movement being performed. The nucleus pulposus takes part in all movements. The gel of the nucleus pulposus is intertwined with the fibrous tissue network growing into the annulus fibrosus. Movements of the spine lead to various degrees of tensing of this fibrous network and the annulus fibrosus. Similarly, forces attempting to dislocate vertebrae are transferred onto the fibrous network and the annulus. These forces, whose intensity depends partially on spinal mobility and partially on posture, have a major influence on degenerative processes within the intervertebral disc. Control of these forces is of basic importance for prevention and the treatment of patients with intervertebral disc damage. Protecting the ailing disc from harmful tensing and loading is a preprequisite for the process of fibrous ankylosis of the affected spinal segment that often produces abolition of symptoms. It is not possible to "switch off" all forces and tensions acting on the lumbar spine. These forces can be reduced and so can their harmful effects. An important role in this regard is played by the maintenance of an appropriate posture both at work and at rest. This must be paralleled by strengthening the muscles that stabilize the lumbar spine.

Good posture plays a major role in protecting the lumbar intervertebral discs from mechanical overload. When the lumbar spine is properly stabilized, a strong extensor spinae and abdominal muscles bear the brunt of many forces that would otherwise be acting directly on the spinal ligaments and joints and intervertebral discs. When an intervertebral disc is damaged, the role of good posture is to ensure maximum spinal performance while simultaneously reducing pressures acting on the spine. Controlling spinal movements prevents repetitive overload of the strands of elastic fibres of the annulus fibrosus and the nucleus pulposus.

Any prevention programme for low back pain should be based on several principles:

- the spine should be maintained in a neutral position. Unnecessary bending, straightening or rotation are to be avoided,
- avoid a 'tired' posture where the physiological spinal curves are accentuated. The abdominal muscles, extensor spinae and the gluteal muscles should maintain a constant appropriate tone,
- the spine should be erected vertically when sitting and standing to reduce the likelihood of the development of shearing forces,

- during movement and exertion, the spine should be controlled by muscles to ensure stability and a safe amplitude of movement.

3.3 Pelvic tilt

Posterior inclination of the pelvis when carrying weights and performing exercises is recommended by many textbooks. This habit leads to spinal flexion and, from the very outset, puts a strain on the annulus fibrosus and posterior spinal ligaments, potentially increasing the risk of damage to the intervertebral disc. A neutrally aligned spinal column (i.e. one that is neither in hyper- or hypolordosis) provides for elastic balance and minimises the risk of damage during increased strain on the spine as a result of muscular contractions. A general practical rule to follow is that the normal lumbo-sacral spinal curvatures should be maintained as they shape out in an erect position **(**McGill,1998).

3.4 The flexibility

Exercises to enhance trunk flexibility should be limited to the movements of flexion and extension without loading. It is not advisable to attempt to attain the extremes of spinal mobility in particular types of damage (Battié et al., 1990; McGill,1998). The outcomes of numerous rehabilitation programmes confirm the importance of achieving trunk stability through exercises with the spine in a neutral position. It is emphasized that ensuring normal mobility in the hip and knee joints is essential.

Appropriate mobility in the hip and knee joints is required for the maintenance of spine-sparing postures. Normal mobility in the hip and knee joints is necessary to protect the spine from excessive movements during daily activity.

3.5 Strength and endurance

The effectiveness of muscle action is determined by "strength" and "endurance", which should be treated as two different components, especially with regard to planning specific exercise programmes. "Strength" refers to the maximum force that a muscle can produce during a single effort to produce torque in a joint. "Endurance" denotes the ability to exert a sustained force over some time. Decreased muscle strength in patients with spinal pathology is a proven fact (McNeill et al., 1980). Several works have suggested that endurance is more important than strength in prevention (McGill, 1998); McNeill et al., 1980). Many injuries occurring during submaximum efforts are associated with decreased endurance of spinal muscles. Patients with spinal pathology need to ensure necessary stabilisation by tensing their abdominal muscles in the erect position, and especially during flexion. While planning exercises, emphasis should be placed on improving endurance by the application of exercises that take longer to complete but generate less loading **(**Cady et al., 1979; McNeill et al., 1980). An important aspect of the methodology of endurance-building exercises is that such exercises do not involve joint movements, which facilitates activation of the abdominal muscles.

3.6 Abdominal muscles

Increased intraabdominal pressures are used to stabilise and protect the lumbar spine during movements and carrying weights. Intraabdominal pressure can be increased by appropriate

exercises for the rectus abdominis and oblique abdominis muscles. Improvement in abdominal muscle strength and tonus enhances the efficacy of the mechanism for transferring loads and mechanical strain from the skeleton to the muscular system by increasing intraabdominal pressure. As a result, some of the forces representing a load on the lower intervertebral discs are transferred to the pelvic floor and the diaphragm. Moreover, improved abdominal muscle strength helps stabilize the spine better. In the lumbar region, the spine is supported posteriorly by the extensor spinae, anterolaterally by the psoas, and anteriorly by intraabdominal pressure, which depends on abdominal muscle tone.

No single exercise will help develop all abdominal muscles. If the goal is to improve muscle strength and endurance, exercises should be prescribed in increased quantities. Trunk curl-ups mainly strengthen the rectus abdominis with little activity from the psoas muscles and the muscles of the abdominal wall (internal and external oblique and transverse abdominal muscle). Raising an erect trunk (sit-ups), with the lower limbs extended or flexed at the knee, increases psoas activity and increases pressure on the lower spine. Leg raising considerably increases muscle activity and pressure on the spine.

Exercises in the lateral recumbent position are a useful type of exercise for low back pain sufferers as they involve the lateral oblique muscles without generating much load on the lumbar region. These exercises also trigger considerable activity of the quadratus lumborum, which is the most important spinal stabiliser. At the beginning of rehabilitation, exercises for abdominal muscles should involve elevating a curled-up trunk and isometric exercises in the lateral recumbent position with support at the knee and the flexed elbow (Axler & McGill, 1997; Hurwitz et al., 2005).

3.7 Quadratus lumborum muscle

It has been questioned whether the psoas muscle is indeed an important stabiliser of the spine. The activity of the psoas muscles is mostly seen during hip flexion. During flexion and axial loading of the lumbar spine, it is the quadratus lumborum that exhibits greater activity. This suggests an important role for the quadratus lumborum in stabilising the lumbar spine. Strengthening the quadratus lumborum muscle and increasing spinal stability can be achieved with exercises in horizontal lateral support (McGill et al., 1996).

3.8 Extensor spinae

Most exercises for the extensor spinae muscles are associated with considerable load on the spine produced by externally generated pressure and shearing forces.

Exercises involving keeping one leg extended with the body being supported on the hands and the other knee produce little external loading of the spine but simultaneously generate an extension torque, resulting in increased activity of the extensor spinae muscles. Unilateral extensor spinae activity is sufficient. Since the activity of the contralateral extensor spina eis low, the total load on the spine is decreased. Alternate extension of the lower limbs produces alternate engagement of the extensors spinae (Hurwitz et al., 2005).

3.9 Aerobic exercises

Numerous studies have revealed that low back pain sufferers demonstrate reduced aerobic capacity. The importance of aerobic exercise in reducing the incidence of pathology of the

lower spine (Cady et al., 1979) and in the treatment of patients with low back pain is well documented (Nutter, 1988).

Some studies raise the causality question as low back pain often affects professional athletes, who have excellent aerobic capacity. Casazza et al. reviewed the available literature on the role of aerobic training and improving cardiovascular performance. They found that it is not clear whether it is low back pain that leads to decreased exercise capacity or whether reduced exercise capacity contributes to the development of low back pain. The authors noted that low back pain has lower intensity in patients with normal exercise capacity and they are convinced that there is a rationale for including aerobic exercise in the rehabilitation programme (Casazza et al, 1998). Videman et al. revealed the presence of more advanced degenerative changes and disc protrusion in weight-lifters and footballers compared to runners (Videman, 1976).

Improved aerobic capacity may increase perfusion and oxygen supply to all tissues, including muscles, vertebrae and spinal ligaments. Aerobic exercise may reduce the influence of mental factors on low back pain by improving mood, diminishing depression and increasing pain tolerance **(**Anshel **&** Russell, 1994). It is theoretically possible that such exercises increase the body's ability to lyse scar tissue via the action of tissue plasminogen activator (Szymanski & Pate, 1994). Improvement of aerobic capacity should be combined with a rehabilitation programme aiming to restore normal mobility of the lumbosacral spine, strengthen trunk muscles and restore normal body mechanics. Limiting rehabilitation to aerobic exercise would not be sufficient. It is important to avoid situations that reduce exercise capacity. This principle can be implemented at the very start of treatment by reducing the length of the period of bed rest and immobilisation. Patients with decreased overall exercise capacity should be instructed about the basics of aerobic exercise and evaluation of target exercise intensity by measuring the heart rate or assessing subjective fatigue.

3.10 Regular physical exercise

Particular importance is ascribed to exercising regularly (Ben Salah Frih et al., 2009). Temporary, emergency rehabilitation of patients with disc herniation at L4-L5 does not prevent disease progression. Failure to exercise regularly affects patients' physical performance and results in inability to work and perform self-care in more than 22% of patients within 2 years (Friedrich, 2005). The results of Laursen's observations confirm that regular rehabilitation is indispensable in conservative therapy (Laursen & Fugl**,** 1995). Observations show that exercise intensity does not have a significant effect on long-term outcomes of rehabilitation of patients with LBP (Mellin et al, 1993). During the immediate post-operative period, programmes of intensive exercises produce better outcomes. (Friedrich et al., 2005; Ostelo et al.**,** 2003).

It is also often emphasised that regular physical exercise has a favourable effect on surgical outcomes in intervertebral disc herniation. The discopathic patient should not wait for a miracle cure to relieve the dysfunction and suffering completely and permanently but should start to participate actively in the treatment process. Intensive exercise from the 4th – 6th week after surgery onwards significantly improves the functional status of patients and reduces the time needed to return to work. A programme of motor rehabilitation introduced at a later stage does not produce such favourable therapeutic effects (Ostelo et al.**,** 2003).

Kjellby argues that repeat surgery is less common in patients engaged in rehabilitation programmes (Kjellby-Wendt et al., 2002).

Patients with acute and subacute low back pain perform exercises most regularly. A study by the present author found that the proportion of those patients exercising and the amount of time devoted to exercise weekly increased with the duration of the disease. Within 6 months following the onset of back pain, 51.4% of patients performed spinal exercises regularly, of whom only 15.4% exercised for 2 hours a week. In long-term follow-up (5 years after onset), 53.6% of respondents reported exercising regularly, 17.9% of whom exercised for more than 2 hours a week.

OUTCOME MEASURE	TIME PER WEEK		
	LESS THAN 1 HUOR	1-2 HOURS	MORE THAN 2 HOURS
Pain intesity V-A scale (1-10)	4,51±1,72	4,12±1,26	3,35±2,31
Functional status OLBPDQ (% of normal)	50,8±11,3	52,8±9,6	59,9±8,4
Occupational activity, F-EORS scale (% of normal)	63,1±21,0	57,7±11,1	59,8±21.3
Depresion index, S-RDS scale	0,61±0,12	0,56±0,10	0,48±0,14

Table 1. Treatment outcomes according to the time alloted to exercise per week

Surgically managed patients appreciated the importance of regular exercise the most during immediate and short-term follow-up. In this period, about 60% of patients reported performing therapeutic exercises, with most, however, exercising for one hour per week. At four years post-surgery, the total number of exercising patients had decreased by approximately 4%, while the number of patients exercising for more than 2-3 hours a week had risen by approximately 4%. Physical exercise was performed by 58.8% of men and 50.4% of women. A beneficial effect of exercise on the functional status, pain intensity and mental state was recorded only in the group exercising for more than two hours a week. The study indicated that the use of physical exercise by patients with low back pain is insufficient, with only approximately 20% of patients exercising long enough. Patients definitely prefer passive treatments to alleviate pain (massage, physiotherapy). Exercises of the backbone are performed for a short period, irregularly and usually only when the pain is more intense. Therefore, the exercises cannot wholly fulfil the important preventive and therapeutic role they are attributed (Radziszewski, 2007).

4. Summary

Numerous authors emphasise that a programme of regular motor rehabilitation is the most efficient modality of conservative therapy (Alaranta et al., 1994; Caby et al., 2010; Kjellby-Wendt et al., 2002; Koopman et al., 2004; Sherman et al., 2010). Regular physical exercise is a way to achieve many beneficial effects, such as reduction of pain, strengthening of the spinal muscles, optimisation of the distribution of load on the spinal structures, enhanced

stabilization of the motor segments of the spine, improved posture and increased overall physical capacity of the body. The precise mechanism by which exercise alleviates pain has not been fully elucidated, although it may be associated with enhancing the nutrition status of the disc. Physical exercise, by stimulating changes in pressure within the intervertebral disc, may improve the mechanisms of osmosis that underlie disc nutrition.

The methodology of exercise attributes a significant role to strength- and endurance-building exercises. Muscle strength is of key importance for trunk stability. Augmentation of the spinal curvatures may be due to weakening of the paraspinal muscles. Epidemiologic studies have shown that patients with strong muscles less frequently complain of back pain. In healthy people, the extensor muscles of the trunk are stronger by 30% than the flexor muscles. However, it is believed that decreased strength is less important in back pain syndromes than decreased endurance capacity of dorsal and abdominal muscles (Davies et al., 1979; McGill**,** 1998).

Exercise accelerates repair and substitution processes in the musculoskeletal system and internal organs, and prevents the development of detrimental substitute motor patterns. It also prevents the development of secondary changes in bones, joints, muscles and ligaments and cardiorespiratory complications. The body's overall physical capacity is also improved. The main aim of exercises involving movement is to break the vicious circle of pain by reducing reflex increase in paraspinal muscle tension. Exercise also serves to improve stability of the lumbar spine by increasing intraabdominal pressure and restoring muscle balance, which prevents the recurrence of symptoms. Kinesiotherapy in low back pain should be well chosen and appropriately dosed. The notion of choice applies to exercise duration, the number of repetitions of an exercise and the duration of a series of exercises. The technique of therapeutic exercises is also important.

An exercise programme should begin with cycles of flexion and extension exercises serving to decrease stiffness and relax elastic structures. This will result in decreased load on the spinal joints during further exercises. The next batch of exercises should serve to improve mobility in the hip and knee joints and should be followed by exercises for the main spinal stabilisers, starting from abdominal muscles, with the spine in a neutral position throughout this stage. These, in turn, are followed by an ordered sequence of exercises in lateral support to strengthen the quadratus lumborum and oblique abdominis muscles, and exercises for the extensors spinae. The programme should be individualized with regard to the number of repetitions and duration of individual exercise items. The goals need to be clearly specified. Importantly, exercises should be performed in the pain-free range as much as possible. General fitness exercises should not be omitted from a programme for rehabilitation of low back pain sufferers (Nutter, 1988). A basic objective of the exercise set recommended by us is to restore normal static and dynamic balance and motor patterns. Improvement in motor function and alleviation of pain can often be observed following several months of exercises (Donchin et al., 1990 ; McGill**,** 1998). Of significance for LBP prevention is compliance with the principles of ergonomics during daily activities.(Zauner-Dungl et al., 2004))

5. Conclusion

The most important types of exercise for preventing low back pain are exercises for abdominal muscles, dorsal muscles, gluteal muscles and quadratus lumborum muscle. The

most appropriate exercises should be chosen for individual patients. "Endurance" rather than "strength" should be emphasized during exercise selection (low-load exercises repeated several times). Exercising on a daily basis is the most effective approach.

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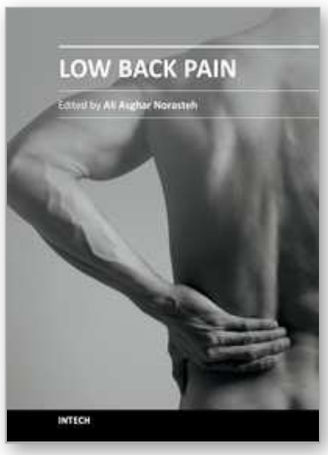

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This book includes two sections. Section one is about basic science, epidemiology, risk factors and evaluation, section two is about clinical science especially different approach in exercise therapy. I envisage that this book will provide helpful information and guidance for all those practitioners involved with managing people with back pain-physiotherapists, osteopaths, chiropractors and doctors of orthopedics, rheumatology, rehabilitation and manual medicine. Likewise for students of movement and those who are involved in re-educating movement-exercise physiologists, Pilates and yoga teachers etc.

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