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Low back pain (LBP): physical therapy approach*

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Therapeutic management of low back pain is often arbitrary and based on the caring health care professional's personal experience. Less frequently, management is based on clinical data produced by comparative investigations employing scientific methodologies in multidisciplinary units combining the skills of a rheumatologist, physiatrist, physical therapist, occupational therapist, orthopedist, social worker, psychologist and/or psychiatrist and rheumatology/rehabilitation nurses[9,11].

The physician caring for the subject with LBP needs to precisely ascertain the stage of the disease, the presenting features and symptoms, the biomechanical changes, the severity of the referred pain, the changes of the paravertebral muscles, and the psychological consequences of the disease. Additionally, its causes should be sought as well as the disease's mode of presentation, that is, acute, recurrent, subacute or chronic. It is also important to determine the patient's acceptance of previous treatments, the degree of incapacitation for routine activities, the effects of planned exercises and the ergonomics of the patient's professional activities. The social and economical issue regarding matters of workers compensation is also a challenge because of patient simulation.

Low back pain is perhaps the best example of the shortcomings of the disease-illness paradigm as a simple model of disability[20].

Although back pain is a common cause of disability, a few cases display an anatomical abnormality accounting for the clinical findings and symptoms. Even in cases where a diagnosis of herniated disk is attained, the patient's degree of disability may show no bearing with severity of the symptoms.

Most patients with low back pain respond to a course of conservative management. However, the components of nonoperative therapy that are effective in treating and preventing low back pain continue to be debated in the literature[4,5].

Lahad et al[15] reviewed a total of 190 papers to find 64 studies that discussed the efficacy of back and aerobic exercises, education, mechanical supports, and risk factor modification (cessation of smoking and weight reduction) for the prevention of back pain in asymptomatic individuals. Despite the fact that only a few data support its beneficial role, exercises that strengthen back and abdominal muscles is the intervention associated with a decreased rate in the frequency and duration of low back pain[8,32]. Minimal evidence exists for education, and there are insufficient data confirming efficacy of mechanical supports and there is no evidence for risk factor modification as a mean of preventing low back pain. The generalization of these data to the general population must be made with caution because the published studies were conducted in the workplace.

In this paper, we discuss some therapeutical alternatives and rehabilitation programs for idiopathic low back pain and for those cases of low back pain caused by biomechanical imbalance[9,11].

Rest

A two to three-day bed rest is recommended for mild to moderate cases whereas a period of 1 to 2 weeks of rest can be recommended for cases where radiculopathy is present. It is likely that a bed rest period of over three days does not decrease the disability rate. Rest should

be on a hard surface, in a confortable supine position, with the lower limbs flexed. Interestingly, several reviews, including the Quebec Task Force (1987) and the Agency for Health Care Policy and Research (AHCPR) guidelines, have noted some benefit from limited rest and did not note any benefit from therapeutic exercise in the acute setting of mechanical low back pain[24,25].

Rhythmic and smooth stretching exercises are recommended once the symptoms begin to subside (pain, paravertebral muscle spasm and antalgic scoliosis). In-bed lumbar traction is usually not recommended at this stage. Postural education and biomechanics should be initiated as early as possible. The patients should be encouraged to remain as active as tolerated early in the course of LBP. Malmivaara et al[16], have shown the benefits of using return to graded functional activities in the management of low back pain, rather than a specific time of rest or structured exercise program.

Physical therapy

An accurate diagnosis of the causes of the LBP and treatment objectives play a definitive role in the determination of the type of physical therapy to be employed for LBP. Several treatment modalities have been recognized to date. However, very few control studies have definitely determined efficacy rate and outcomes. Pain syndromes are known for their multifactorial features and the different limitations, regarding the methodologies hinder the performance of randomized studies in the determination of clinical efficacy of specific treatment modalities. Additionally, a placebo effect can be present in up to one third of the cases receiving physical therapy[30].

The relief of acute pain demands local superficial or deep heat or ice pack therapy.

TENS (transcutaneous electrical nerve stimulation) is an alternative to relief the pain. It is easier to perform and well tolerated by the patients as a procedure to obtain analgesia.

Exercises are the cornerstone in the physical therapy and rehabilitation. This topic will be discussed in further detail elsewhere.

The lumbar traction is less used as treatment because, in certain situations, it can increase the pain.

Postural education, health ergonomics applied to the workplace and at home should also be recommended. Schools for vertebral column rehabilitation – back school – have been producing good outcomes in diminishing the frequency of LBP.

In chronic cases with acute bouts of pain, the employment of braces and abdominal supporting belts (elastic belts) are effective in diminishing the pain. However, the abdominal belts should be worn only for a brief period of time to avoid atrophy and weakenss of the abdominal wall.

There is no clear-cut agreement about the indications of physical therapy for low back pain. For instance, Van de Hoogen et al[31] completed a prospective study cohort of prognostic factors for the resolution of low back pain. Forty percent of the eligible patients dropped out of the study, biasing the results for patients with more severe disorders, patients who received physical therapy had a slower improvement rate.

Treatment management planning, for patients with chronic manifestations, should take into account the affective and the nociceptive components of the pain. The delay in the recovery of patients with low back pain may be related to other factors unrelated to the patient's clinical status. Recovery can be strongly influenced by psychological and occupational factors. It should also be remembered that chronic low back pain patients become phisically unfit, requiring a more comprehensive assessment. Specific management of chronic LBP should include the following points: self-application, easiness, low cost, satisfactory efficacy.

Thermal agents

The application of heat or ice in the lumbar region aims at controlling the pain, muscle contraction, and the inflammatory reaction in certain cases.

Heat

Heat and cold have been known for some time to reduce pain. They appear to do so by equalizing the temperature gradient between injured and non injured tissues. In addition to relieving pain, these modalities have other actions, including effects on flexibility, joint stiffness, blood flow, and inflammation. To take advantage of these properties, both for treating pain and other conditions, numerous heating and cooling devices have been developed.

Main Treatment Modalities for rehabilitation and physical therapy employed for LBP[9,11,32]

Symptoms	Therapy
Pain	Rest, heat, ice, TENS massage, hydrotherapy
Mechanical dysfunction	Education, rest, braces, belts, isometric and stretching exercises
Muscle weakness	Flexion extension exercises under supervision, global postural rehabilitation

Heating modalities create both local and reflex effects. The local response is an increase in tissue temperature and metabolic rate. The reflex effects include both regional and generalized responses. The regional responses increases blood flow to the treated area and muscle relaxation. The generalized responses include increased blood flow to he contralateral limb, sedation and relaxation, sweating, and body thermoregulation. The local responses are more vigorous as a rule.

Superficial heat modalities

Heating modalities are generally prescribed based on their ability to heat the body tissues either superficially or more deeply.

Superficial heat causes a reflex increase in blood flow to the skin and muscles below the heat as well as increasing blood flow in the skin of the limbs distal to the site of the heating. In conditions of painful muscle splinting, such as acute neck or back strain, superficial heat may provide significant relief of pain.

There are a number of different superficial heating devices. Wet or dry heat includes hot pads, hydrotherapy and infra-red.

Deep heating

When tissues deeper than 3 to 5mm need to be warmed, superficial heating agents cannot reach them. There are three types of deep heating modalities. Only one, ultrasound, is used with any great frequency, chiefly indicated for chronic backache, to increase extensibility of the connective and muscle tissue.

Microwaves are electromagnetic radiation forms which are preferentially absorbed in water-containing tissues. They mainly heat muscle. Microwave diathermy is relatively safe and easy to use. On the other hand, it does not usually offer a clear-cut advantage over ultrasound. If available, and if selective muscle heating is desired, it may be a good option to use.

Short waves forms are only used for selected patients without neurological lesions.

Guidelines for use of therapeutic heat

1. When using superficial heating modalities, the patient should not lie on top of the heating source. This is more likely to cause skin burns because the pressure from the body weight masks the pain and prevents capillary blood flow from dissipating the heat.
2. When using heat to help increase flexibility, it should be accompanied and followed by prolonged gentle stretching. Heat alone, without the stretching, will not increase flexibility. As a rule, the highest dose of heat that can be tolerated without producing tissue damage is required to have an effect on flexibility. This technique is mainly used to treat contractures.
3. Heat increases blood flow to the tissues being warmed. This increase in blood flow may help to resolve inflammation in some cases. In other instances, it aggravates the inflammation. It may be followed by massage to reduce edema.
4. The increase in blood flow "washes out" the heat. Thus, after a certain amount of time, prolonging the heating session is no longer useful. For most superficial heating sessions, 20 to 30 minutes of heat application is useful. For deep heating, 5 to 10 minutes per field is used.
5. Let the patient's sensation of warmth guide treatment. For ultrasound, a useful technique to achieve optimal heating is to go right up to the point of pain and then back off on the intensity slightly.
6. Vigorous heating is not generally indicated in acute injury or in inflamed joints. In these situations it may worsen the inflammation.

Cryotherapy

Cold application is commonly used in musculoskeletal conditions, especially after acute injury. It helps decrease tissue inflammation and swelling. It also helps to decrease pain sensation, either by acting as a counter irritant or by blocking pain transmission directly.

Cold modalities: Ice-Packs
Vapoocolant spray

Cold produces vasoconstriction, which decreases blood flow to the area being treated. Thus, the cooling effect is not "washed out" as quickly as with heat, and the effects are more long-lasting. When the tissues are cooled enough to cause damage, there is an axonal-reflex mediated vasodilation that increases blood flow to prevent frostbite. This level of cooling should not be approached in a clinical setting.

Cryotherapy is usually used in the first 1 to 2 days after injury. It is commonly applied for 10 to 20 minutes every 1 to 2 hours as tolerated. It can also be used before or after exercise to decrease inflammation. In states of painful muscle splinting it can reduce pain and relax the muscle.

Therapeutic heat and cold

Both therapeutic heat and cold have the physiologic effect of ameliorating pain and muscle spasm[33]. Heat also has the benefit of increasing extensibility of collagen when combined with stretching. Cold can decrease swelling if applied after early trauma.

As a rule, either heat or cold can be used for soft tissue pain depending on patient preference. Cold application may be used later on. Myofascial pain often re-

sponds to ice massage. This is performed by a helper massaging with an ice block in the direction of the muscle fibers until deep cooling, pain relief, and muscle relaxation are achieved. This can either precede or follow an exercise or stretching session.

Electrotherapy

- TENS (high and low intensity) and other modes of electrical stimulation.
- Galvanic currents, iontophoresis, dyadynamic currents, electroacupuncture, interferential current, and so.

Electrical modalities

Transcutaneous neuronal electrical stimulation (TENS) modulates pain by applying electrical impulses to the skin. There are two basic types: high frequency, low intensity TENS (conventional TENS), and low frequency, high intensity TENS (electro-acupuncture). Conventional TENS works due to the "gate" theory of pain. Presented simply, this involves incoming cutaneous sensory and proprioceptive impulses carried through larger myelinated nerve fibers, which inhibit pain impulses carried more slowly by unmyelinated nerve fibers at the level of the dorsal column of the spinal cord. The faster impulses arrive at the dorsal first and "close the gate," forestalling propagation of the slower pain impulses[26].

The second type of TENS, high voltage galvanic stimulation or electro-acupuncture, utilizes a more pronounced "jolt" of electrical stimulation, which increases endogenous opioid substances in the brain. Electroacupuncture may be less useful in the treatment of some pain disorders because of the painful nature of the stimulus itself.

The advantage of TENS is that it is noninvasive. Several different electrodes and stimulator settings should be utilized before discontinuing it for failing to relieve pain. Individual response to TENS is the rule. There are a few contraindications to TENS. Theoretically, it may cause malfunction of cardiac pacemakers. Hypersensitivity to the electrodes (skin irritation) occasionally necessitates discontinuation, but can be minimized if different electrodes are used.

Mobilization techniques

- Manipulation

These are passive mobilizations indicated for acute backaches of facet syndromes. It should be carried out by an experienced professional. Usually this procedure is not beneficial in cases of LBP lasting longer than thirty days. There are also no studies demonstrating that manipulation reduces the incidence of chronic backache.

- Massage

It is an interesting procedure utilized together with other techniques for relief of pain and decreases the muscle tension.

- Hydrotherapy

Different forms of hydrotherapy may be used (hydrokenesitherapy and hydromassage among others). It relieves backache by degravitation of the spinal column and the heat, permits limbering-up exercises aimed at increasing muscle force, and corrects of lumbar hyperlordosis.

- Lumbar traction

This can be mechanical or electrical attempting to produce continuous or intermittent stretching of the vertebral ligaments to achieve a small separation between them. Nowadays, it is rarely indicated and in general its use is debatable. Studies have shown that although it is well-tolerated, it is not helpful in controlling sciatic pain and backache, except in some special cases which are unpredictable beforehand. Major forces can be applied if the patient tolerates the procedure. However, there is no evidence of its direct effect on reducing pain, although it can decrease the pressure within the disc. The physician should determine whether there is improvement during traction, otherwise it should be discontinued. Indication of traction, combined with prior use of heat or muscle relaxants, can aid in the mechanical action of traction[9,19].

Corsets

In the absence of marked spinal instability, lumbar pathologies, especially during the acute stages, can require a comfortable appliance: a corset is well-accepted for short periods. It must limit lordosis and increase intra-abdominal muscle support without limiting movement. Its continuous use can promote the appearance of osteoporosis and weakening of abdominal muscles. The latter can be avoided by progressive physical activity and stretching exercises. The patients should be encouraged to remove the appliance whenever possible, so long as the pain is under control and the functional characteristics of the lumbar segment can be liberated. Elastic support girdles can help to decrease painful symptoms.

Exercises and static imbalance[2,3,7,21,27]

The role of exercise differs in patients with subacute and chronic low back pain from those with acute pain. Patients with chronic low back pain have weakness of the abdominal, trunk, and lower extremity musculature. Weakness in these muscle groups may predispose patients to associated recurrence or persistence of low back

pain. Studies have shown that exercise programs for strengthening trunk musculature in subjects with chronic low back pain are successful in producing increased strength. One study, using a graded-exercise program in patients with subacute low back pain (7 to 9 weeks in duration), was successful in restoring patients to occupational functional activities and in facilitating return to work[13].

Programmed postural reeducation exercises permit teaching correct postural stances, improving flexibility, stability and balance. Educational programs, including back school have been reported to improve individual patients with LBP[23]. Nevertheless, recently, Daltroy et al[6] studied 4,000 postal workers in a five-year controlled trial of back school education for prevention of LBP. The education program included three hours of training and four reinforcement sessions. The rate of LBP injuries was the same, both in the treatment and in the control groups. Postural education training for the postal employees may not be useful for decreasing work injuries. Questions remain concerning the applicability of this study to all work situations.

Populational tendencies in patients with chronic low back pain, described by Mayer et al[17] demonstrated a reduction in performance of trunk extensor and flexor muscles when compared with a control group. Greater involvement of the extensors led to an inversion of the percentual relationship between flexors and extensors torque in patients with chronic low back pain in isokinetic evaluation. These tendencies are observed both in men and women with chronic pain and is more evident in females.

In another study, Mayer et al[18] evaluate the computadorized tomographic scan images of the transverse area of the paravertebral and psoas muscles in chronic low back pain patients during the postoperative period. The authors correlated reduction of muscle density to reduction in isokinetic performance.

According to Hides et al[12], multifidus muscle atrophy is of difficult recovery after an episode of low back pain. The author speculates the existance of a reflex inhibititory mechanism of this muscle during mechanical dysfunction of the lumbosacral area, similar to the quadriceps reflex inhibition due to knee disorders. Painful afferent stimuli would activate a long reflex pattern. Damage of the posterior ramii, which inervate the paravertebral muscles, as observed after back surgery, is not necessary to promote intense atrophy of these muscles. The authors also say that this atrophy is already present after three weeks of pain. They describe the ultrasonographic evaluation of the transverse diameter of the multifidus muscles in the first acute episode of low back pain of mechanical origin in 41 patients. Atrophy of that muscle was frequently present. Patients of this study were divided into two groups. One group of patients performed supervised and specific exercises to strengthen the multifidus muscle. After ten weeks, ultrasonographic evaluation showed decrease of muscle atrophy in the group treated with exercises. Persistance of atrophy was observed in the conventionally treated group. These findings were also present in patients with no pain and who had returned to normal functional level. The author concludes that multifidus atrophy after mechanical low back pain do not present spontaneous remission and can be responsable for recurrence in a large percentage of cases. Specific exercises for the recovery of this muscle must be prescribed in the treatment of these patients.

Reflex inhibition should be considered due to mechanical disorders, to a lesser segmental mobility, and in some cases due to the presence of myofascial and ligamentous pain in the dorso-lumbar area.

The lesser involvement of trunk flexor muscles, observed in many studies related to chronic low back pain, may be explained by: a) the absence of a specific reflex inhibitory mechanism, b) a smaller number of joints related to these muscles, and c) a greater activation of these muscles in daily activities.

Trunk extensor muscles deficiency should be considered in planning rehabilitation programs for chronic low back pain patients. Specific exercises should be included for the strengthening of these muscles.

Kraus[14] developed a simple methodology for the clinical evaluation and detection of muscle deficiencies involved in postural disorders. He also described a systematic sequence of exercises to correct these deficiencies.

Some studies describe reversion of paravertebral muscle atrophy in patients with low back pain of mechanical origin after a specific training[12,22]. The group studied by Rissanen et al[22] performed weight resisted exercises; the group studied by Hides et al[12] performed isometric exercises with visual feedback of ultrasonography of the multifidus muscle.

Other approaches proposed in the literature include isometric training in multiple angles of trunk flexion using equipments[10] and isometric training with surface eletromiography feedback[1].

Isokinetic training was described by Timm[28,29] and showed to be the most effective approach for functional recovery of chronic low back pain patients when compared to physical modalities, back school and conventional exercises. The group trained in isokinetic equipment presented the lowest rates of recurrence and the greatest rates of return to work in a 5-year follow-up. Some

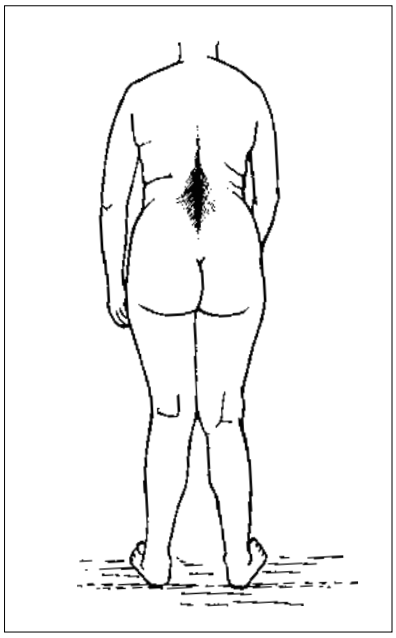


Figure 1 - Aspect of the secondary lumbar hyperlordosis as a result of the lower limbs imbalances.

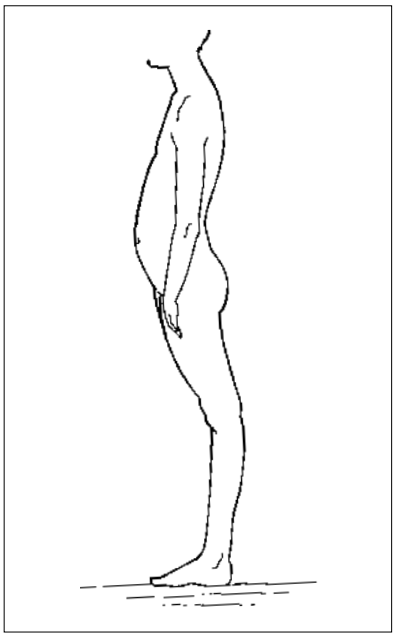


Figure 2 - Primary lumbar hyperlordosis associated to the weakness of the pelvis' retroversor muscles.

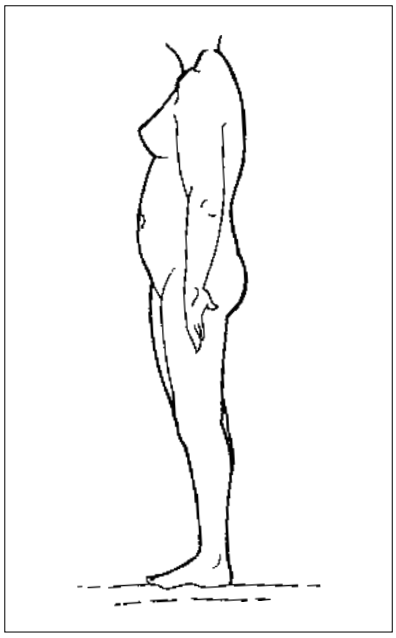


Figure 3 - Lumbar retification as consequence of dorsal straight alteration.

examples of postural exercises for the chief static imbalances will be given. We know that backaches are commonly associated with neural compressions, i.e., herniated discs and arthroses. These elements are usually what bring on the imbalances. In order to control these problems a thorough knowledge of their correction is necessary, utilizing well-oriented and specific exercises indicated by qualified professionals. Among the more common alterations are hyperlordoses, kyphoses, scolioses and flat back.

I. Lumbar hyperlordosis

A balanced lordosis is one in which the pubic symphysis is aligned with the mentonian symphysis (Mezieres occipito-scapulo-sacral alignment). It is normally considered a compensation curve.

Lumbar hyperlordosis is the compensation of a static postural imbalance, caused by ascending or descending alterations. These determine biomechanical vertebral modifications, bearing in mind that pelvic anteversion and lumbar lordosis go hand in hand. When the problem is in an ascending direction, i.e., imbalances that begin from the lower limbs (for example, flat feet in which there is inadequate support of the feet on the ground causing internal rotation of the knees or external rotation of the tibia, bilaterally and whose compensation leads to internal rotation of the femur), result in primary pelvic anteversion and compensation of this imbalance (Fig. 1) will lead to lumbar lordosis.

On the other hand, pelvic anteversion is also possible due to weakness of the muscles of retroversion (oblique fibers of the gluteus major and the pyriform) (Fig. 2). Several causes for the problem in a descending direction, (i.e., lumbar lordosis is primary, followed by pelvic anteversion) are:

- Lack of tonicity of the gluteal muscles with hypertonia of the psoas muscle;
- Contraction of the lumbar muscles with retraction of the tonic part of the psoas;
- Spondylolisthesis due to rupture of the isthmus of L5 (anomaly of the lumbo-sacral transition).

II. Kyphoses and lumbar flattening

Kyphoses and lumbar flattening are almost always pathological and not just a compensation of static postural imbalance.

When the alteration occurs in a descending direction, in the case of a flat dorsum, compensation takes the form of lumbar flattening (Fig. 3).

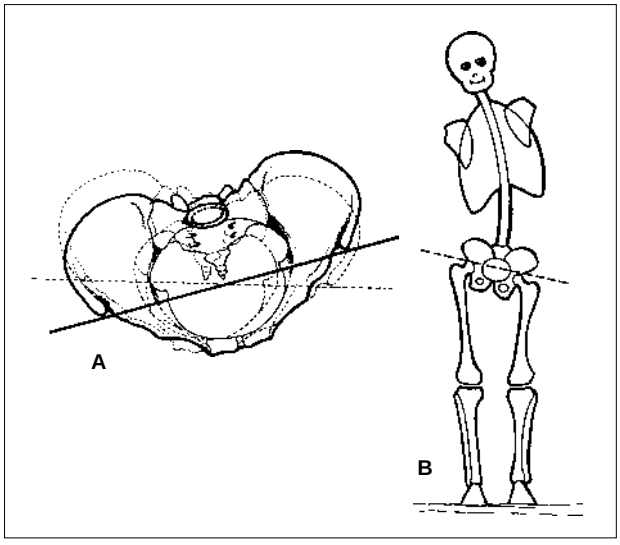
Kyphoses occur when the problem is in an ascending direction or in the lumbar region itself, in cases of thigh-femoral anomaly or fractures with anterior flattening of the lumbar vertebrae (at L1, L2 levels).

III. Lumbar scoliosis

These are usually ascending processes due to rotational imbalance of the lower limbs that produce compensations in horizontal pelvic rotation. Minor differences

in length between lower limbs that cause frontal pelvic imbalance are also possible (Figs. 4A and 4B).

Although exercise programs may play an important part in muscle strengthening and prevention of future or recurrent injuries, there may also be important psychologic benefits. Patients with low back pain may have a "fear" of exercising, and a supervised program may allay this fear and encourage these patients to develop increased strength and the ability to participate in functional activities. Ideally, a program of supervised aerobic activity should be recommended, because of the link between aerobic activity and endogenous opiates, with potential benefits on depressive symptoms.



Figures 4A and 4B - Postures of rotational (A) and frontal (B) pelvic compensations, which are determined by ascending lumbar scoliosis.

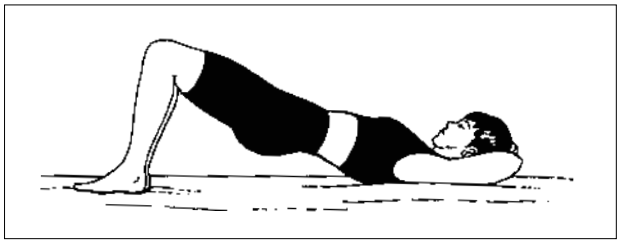


Figure 5 - With feet on the floor, bend the knees. Lift the hips keeping the gluteal muscles contracted for 15 seconds.

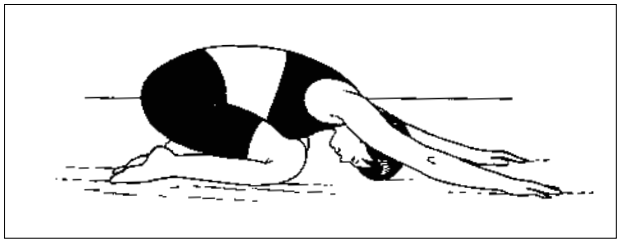


Figure 6 - On your knees, sit on your heels, with palms on the floor stretch the upper limbs frontally.

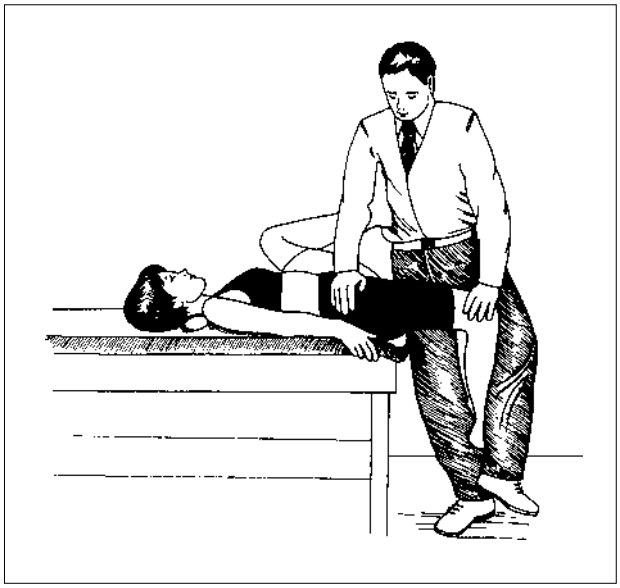


Figure 7 - Lie on a table, bend one of your legs and let the other leg dangle over the table. With one hand, the therapist stabilizes the hip and with the other, forces the knee of the extended leg downward.

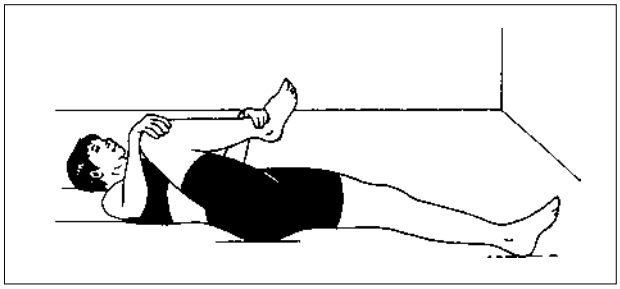


Figure 8 - Stretch legs out on the floor, bring one of them toward the abdomen, supporting one of the hands on the ankle (the tibia remains perpendicular to the trunk).

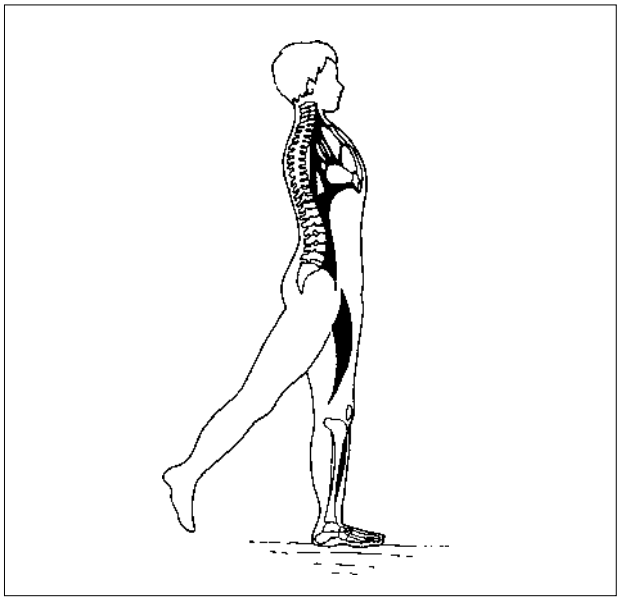


Figure 9 - Anterior muscular chain.

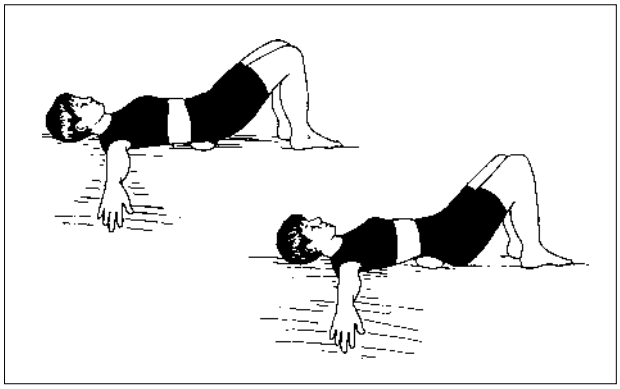


Figure 10 - While lying on a firm surface, place four balls under the lumbosacral region, carrying out rhythmic motions of lifting and lowering the pelvis while alternately contracting and relaxing the abdominal muscles. In the same position rotate the pelvis, alternately to the right and to the left.

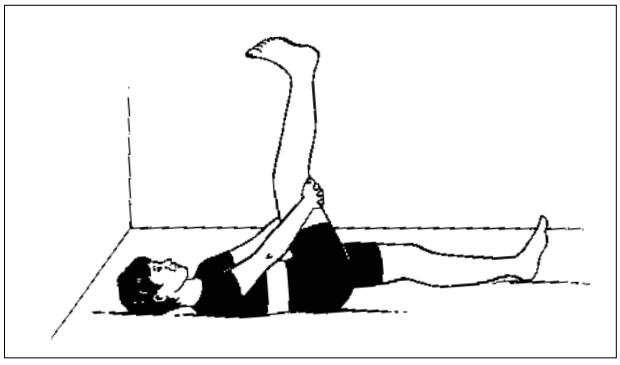


Figure 11 - While lying on a firm surface, keep the left leg extended on the floor, raise the right leg and hold it behind the knee, with flexing the foot. Repeat the same exercise on the other side.

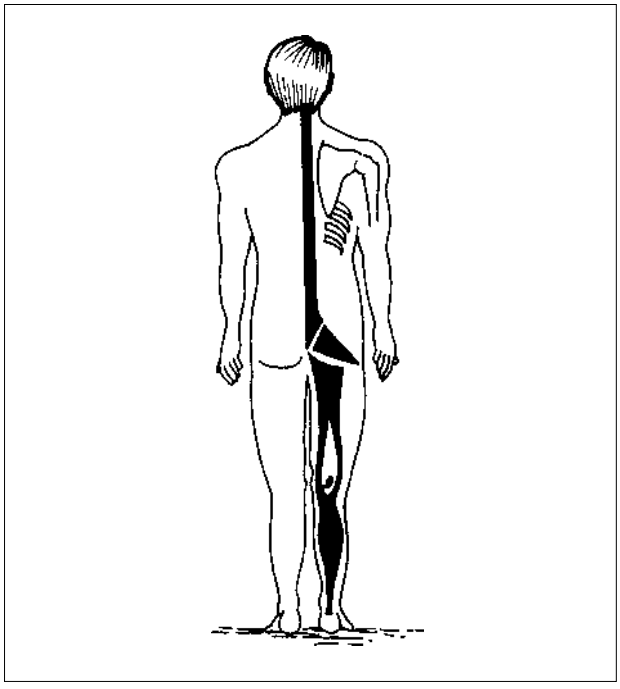


Figure 12 - Posterior muscle chain.

Exercises for posture correction

I. *Lumbar hyperlordosis:* The following muscles should be limbered up: gluteus (Fig. 5), paravertebral (Fig. 6), iliopsoas (Fig. 7), pyriform (Fig. 8) and the anterior muscular chain (Fig. 9), scalene, intercostal, diaphragmatic, and abductor muscles, the psoas, and anterior leg muscles).

II. *Kyphosis and lumbar flattening:* The following muscles must be well-limbered: paravertebral (Fig. 10) and the ischiotibial muscles (Fig. 11) and the posterior mucular chain (Fig. 12), sural triceps, ischiotibial and deep muscles of the hips and posterior paravertebrals.

III. *Lumbar scoliosis:* It is important to correct the frontal (Fig. 13) and rotational (Fig. 14) imbalance of the pelvis.

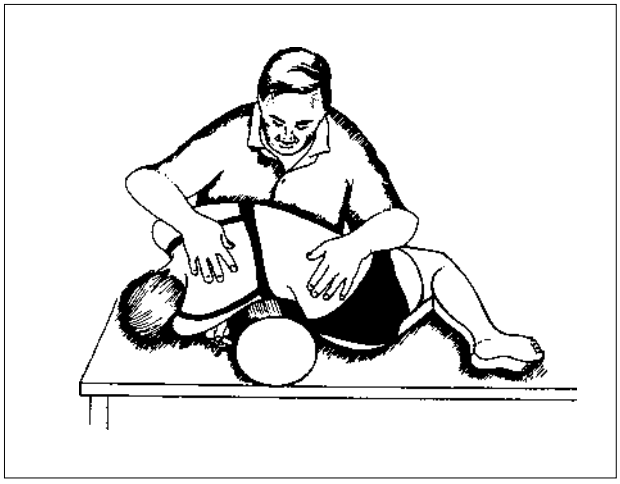


Figure 13 - Lie down on a large roll of hard foam rubber, attempting to invert the lateral curve and stretch the contralateral paravertebral muscles. Use respiration to aid in stretching.

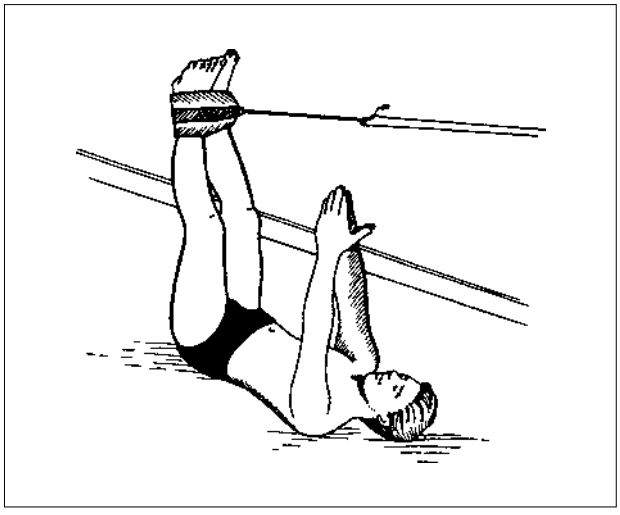


Figure 14 - Lie down and gradually raise the legs upward, clasping them at the waist, maintaining flexion of the feet; the hips are supported on the floor, and the arms are raised.

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