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# Asana-based Exercises for the management of Low Back Pain

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**Abstract**—Low Back Pain is an endemic disorder afflicting a large percentage of people. The aetiological factors are mostly psychosomatic along with postural defects, occupational predispositions and sendentary life styles. Though several rehabilitative techniques are prescribed, no systematic analysis of these are available.

The present study evaluates several simple asanas on the basis of biomechanical principles. These studies also select a set of asanas which work on the back with increasing intensity. A series of tests are evolved to assess the physiological debility of a patient. These test results form the basis of selection of asanas to be prescribed to the patient. A chart is finally provided to enable the therapist to increase the intensity of asanas so that the muscles of the low back can be strengthened systematically and progressively.

The results of clinical trials on 16 patients using this method of asanas selection and rehabilitation indicates the usefulnes of this method for the management of low back pain. Only regular practitioners of these exercises improve while indifferent or improper practice has no rehabilitative value.

## 1. Introduction

Next to the brain itself, the spinal cord is the most important structure in the human body for maintenance of postural equilibrium and for communication. The spine consists of seven cervical, twelve thoracic, five lumbar, five fused sacral and three to four fused coccygeal vertebrae. Viewed in the frontal plane the spine is straight and symmetrical. Looking from the side however, there are three curvatures, an *S* curve with an additional *C* fused at the bottom of *S*. These curves give the spine increased flexibility and better shock absorbing capacity while retaining appropriate stiffness. The intravertebral disc is a multifunctional element subjected to many types of loads. Activities such as jumping increase the load on the discs. Short duration loads (such as during weight lifting) can cause irreparable damage to the discs. The intravertebral discs constitute approximately one third of the overall length of the lumbar spine, while in the rest of the vertebral column, the ratio is down to one fifth only (Finneson, 1980). This increased soft tissue-to-hard tissue ratio as well as the fact that lumbar spine is a primary weight bearing structure accounts for LPB (Low Back Pain) which is so widely experienced.

In this paper, spine pain refers to those pain not related to nor contributed by infection, tumor, disease, fracture or by fracture dislocation. Spine pain is reported most frequently in the lumbar region followed by cervical and thoracic regions, in that order. There are a large number of pain sensitive structures in the spine. The annular fibres, longitudinal ligaments, capsular structures, osseous structures etc, in the spinal system have various nerves innervating them. Spine pain can come from physical, chemical or inflammatory problems associates with these nerves. There is also referred pain whose origin is not understood. *We shall deal only with LBP which has none of the above pathology associated with it.*

The important nonorganic caused of LBP are as follows:

*i) Biomechanical abuse of the body*: Intense and sudden exhertions, postural abnormalities and occupational predispositions fall in this category. Examples include weight lifters, long distance professional drivers and secondary scoliosis.

*ii) Obesity, pregnancy and postnatal recovery*: In all these cases, the mechanism of pain generation is similar to those in the category of weight-lifters. The excess weight pushes the centre of gravity farther away from the spine with the increased lever arm putting excess pressure on the lumbar system.

*iii) Sedentary life styles*: It has been suggested (Krauss, 1965) that LBP can be called a 'hypokinetic disease', implying underutilization of the spinal and associated muscles. Several muscles of the back and abdomen are involved in distributing and supporting the load on the lumbar vertebra if a person stands or lifts extra weights. This is a very common cause of LBP with age related degeneration setting in due to lack of exercise.

*iv) Stress*: A strong correlation between psychological tension and LBP is implicated in some studies (Sarno, 1978) wherein the term *tension myocytis* is suggested. The term tension refers to psychic camponent which is the precipitative cause of LBP. The muscle pathology may have secondary inflammatory changes. It may be a local disorder of contractile state of a muscle leading to muscle spasm (Sarno, 1978).

Often, the above factors are in collusion to produce LBP. The hypokinetic activity makes the muscles weak and unable to support normal structural weight while the stress produces tense and shortened muscles with restricted movements. Doran and Newall (1975) report that from a sample of 262 patients treated in different ways (spinal manipulations, physiotherapy, corsets, analgesics and combination of these), 56 per cent still had back ache at the end of one year. However, other studies (e. g. Lindstrom and Zachrisson, 1970) indicate that physical therapy has an important role in the management of LBP and sciatica. The emerging consensus of opinion of many studies (Nachemson, 1969) is that exercise is very important component which should be performed isometrically especially for abdominal and quadriceps muscles. The back muscles may be exercised isometrically or isotonically. Further, the program should consist of relaxation and limbering exercises along with those that promote elasticity. The latter is necessary since reduced elasticity leads to lumbar flexion or torsion movement which may further stretch a muscle or tendon, precipitating the cycle of low back pain. These two cordinal

aspects - namely, relaxation and improved elasticity - can be effectively met through asana and pranayama practice. Further, isometrics can also be incorporated for abdominal strengthening. However, the treatment of LBP in India is limited mostly to traction and diathermy. Very little active participation is elicited from the patient during physiotherapy. The physiotherapy practiced here is fairly outdated and no novel procedures such as proprioceptive facilitation is incorporated. Though yoga asanas are attempted in isolated institutions methods to rationalize its application to LBP have not been worked out. Even in well - established hospitals, the causative factors, the individual differences, progression of exercises, test methods for suitability and stages of exercise regimen etc have not been worked out. The present study hopes to fill this much required clinical understanding of the role of asanas and pranayamas in the management of low back pain through the application of simple biomechanical principles.

## 2. Biomechanics of Asanas

Asanas involve slow and steady movements and muscles stretch during maintenance of a posture. The asana exercises thus fall in the category of isometrics and muscle relaxation achieved due to stretch. In the use of asanas as a therapeutic tool, slow stretch is a very important method for achieving muscle relaxation and improved motor function. This is similar to rehabilitation techniques that are currently known as Proprioceptive Neuromusclar Facilitation. Relaxation of a muscle (indicated by lowered discharges from the muscle fibres) is obtained by stretching the muscle very slowly and maintaining the stretch over prolonged periods of time (Srinivasan, 1981). Thus, asanas and counterposes work on the muscles through isometrics and further muscles relax through intense stretch. The feedback mechanisms involved also change with improved muscle control due to stretch carried out by the patient himself while this element is absent if the stretch is through external means i. e., through electrical stimulation or through manipulation by the therapist (Vinod Kumar, 1982).

A range of postures can be selected from the available literature on asanas (Smith, 1980). These selections are made on the basis of the work brought on the low back by these asanas. The asanas are listed in Table I, along with the major muscles that are activated during the exercises. Since these asanas work on low back muscles, these are selected for the therapeutic regimen. Each asanas is also graded on the

basis of force which it exerts on the joint during each type of movement. This is also indicated in Table I. The biomechanical calculation proceeds as follows (Ananthanarayanan, 1983).

Consider a hypothetical case of a person of 176 cm height and 60 kg weight. The lengths of different parts of the body (such as head and torso, upper arm, hand, high, leg and foot) are assumed for this person and the portion of body weight along with the centre of gravity is assigned on the basis of available studies. From this, the moment of force of each body segment about the point of attachment is computed. These are then added up depending on the number of segments that are moved while an asana is performed. For example, in *Uttānāsana*, the torso, upper arm, lower arm and the hand are moved about the hip joint; the total moments of these parts amount to 1571 kg cm. Similarly, each asana is classified on the basis of the body parts moved and hence the moment of force generated about the hip joint The actual values computed are shown in Table I. It is evident that the higher the moment, the greater is the force recruited in the back muscles. To maintain the asana positions, thus greater work is put on these muscles. Initially, depending on the intensity of LBP, asanas having

| Type of movement | muscles involved | asana | moment at the joint (needed to move body part against gravity) |
|---|---|---|---|
| Hip extension | gluteus maximus<br>rectus femoris<br>(semi tendinosus<br>semi membranosus) |  dwipadapeatam | 870 kg cms |
| | |  shalabhasana | 2291 66 kg cms |
| Hip flexion | psoas major<br>illiacus<br>(pectimus<br>sartorius<br>tensor fasciae latae) |  apanasana | 870 00 kg cms |
| | |  supine bent leg flexion | 185.00 kg cms |
| | |  vajrasana | 1264.80 kg cms |
| | |  uttanasana | 1571 53 kg cms |
| | |  paschimatanasana | 1571.53 kg cms |

Table I. Major muscles involved and forces at the hip during different asanas (contd.)

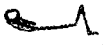
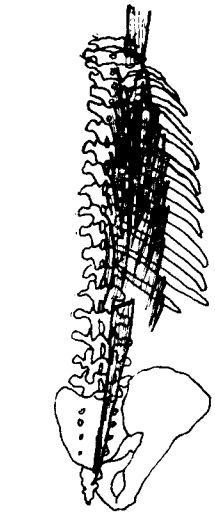
| Type of movement | muscles involved | asana | moment at the joint (needed to move body part against gravity) |
|---|---|---|---|
| Trunk extension | sacro spinalis (semi spinalis multifidus) |  chakravakasana | negligible |
| | |  bhujangasana | 1126.26 kg cms |
| | |  shalabhasana | 2291.66 kg cms |
| Trunk flexion | rectus abdominus external and internal obliques |  supine bent leg flexion | 185.00 kg cms |
| | |  supine trunk flexion | 1263.82 kg cms |
| | |  paschimatanasana | 1571.53 kg cms |

Table I. Major muscles involved and forces at the hip during different asanas

smaller moment and hence lesser work on low back muscles should be recommended. However, in literature, head and torso lift (lying down) is prescribed early in rehabilitation which will put enormous strain on back muscle and is thus contraindicated in the present study. The present biomechanical criteria thus enable a graded selection of asanas so that the low back muslces are slowly and progressively strengthened by prescribing increasingly difficult asans for practice.

### 3. Test and Treatment Schedules

The above summarized method of grading asanas is the basis for rehabilitation of LBP. However, before proceeding with rehabilitation, it is necessary to assess the ability of the patient to carry out the basic movements. For this, a series of seven tests are introduced on the basis of muscle testing devised by Krauss (1965). Charts 1 to 7 summarize the tests to be conducted, the contraindicated asanas in each group. The patient is instructed to carry out the exercises and his inability or pain during a movement will determine the level at which these exercises should be started. The general rules to be followed (and recommended by several workers) are :



sacro spinalis
semi spinalis
multifidus

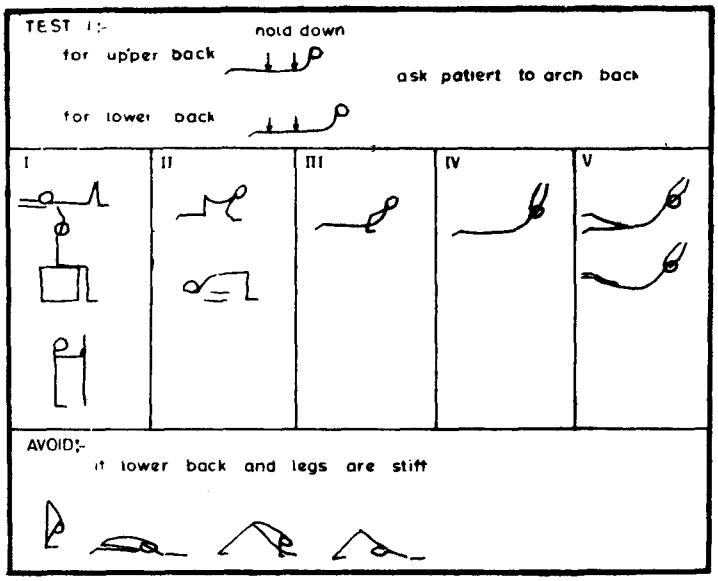
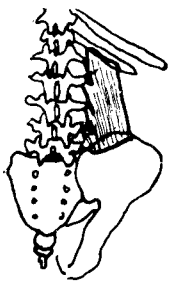



CHART 1



quadratus lumborum

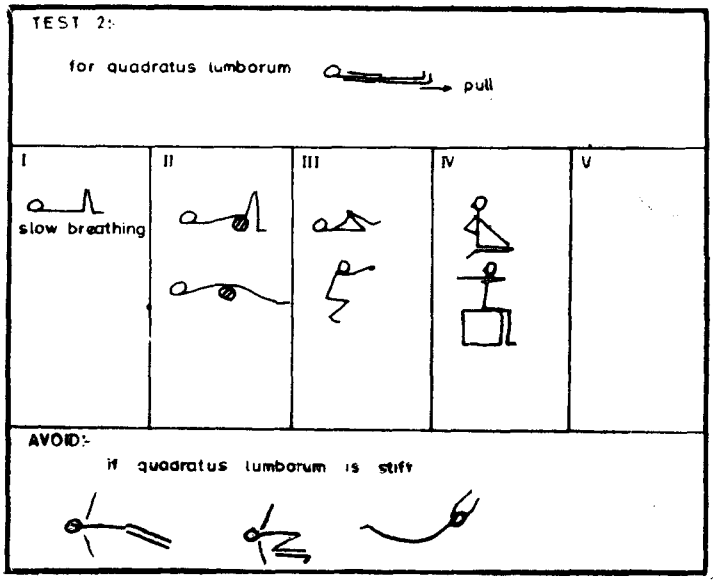



CHART 2

psoas major
illiacus

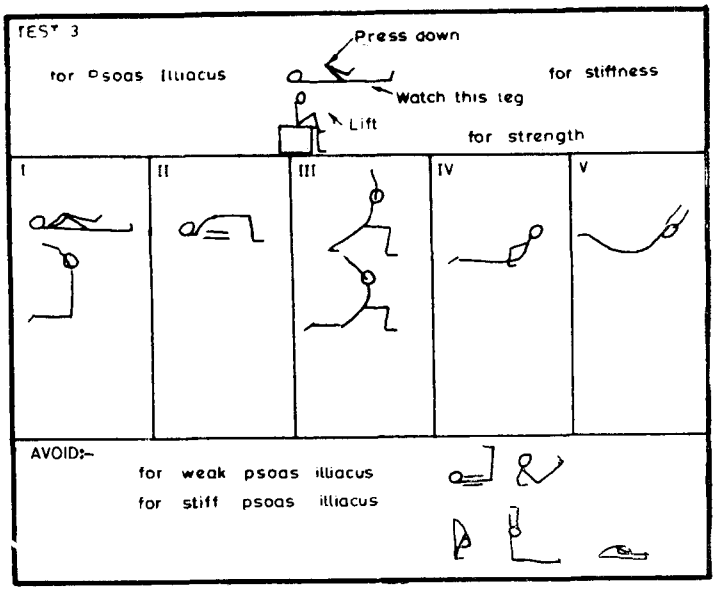



CHART 3

gluteus maximus
rectus femoris
semi tendinosus
semi membranosus

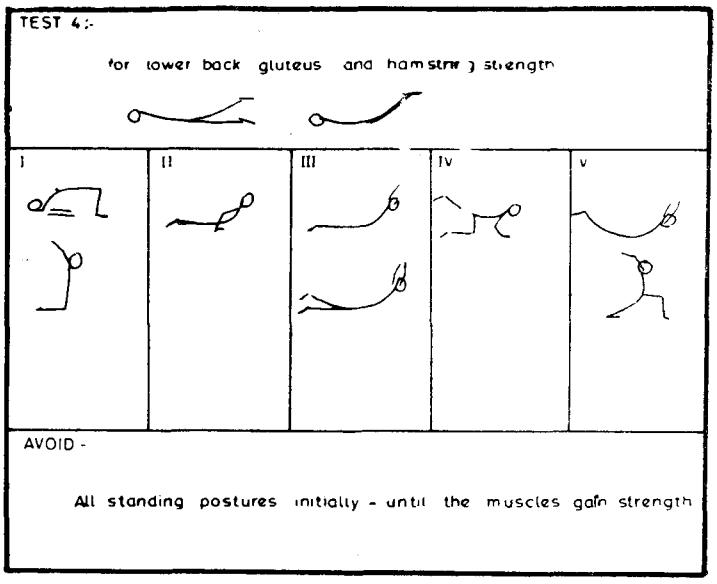



CHART 4

rectus femoris
semi tendinosus
semi membranosus

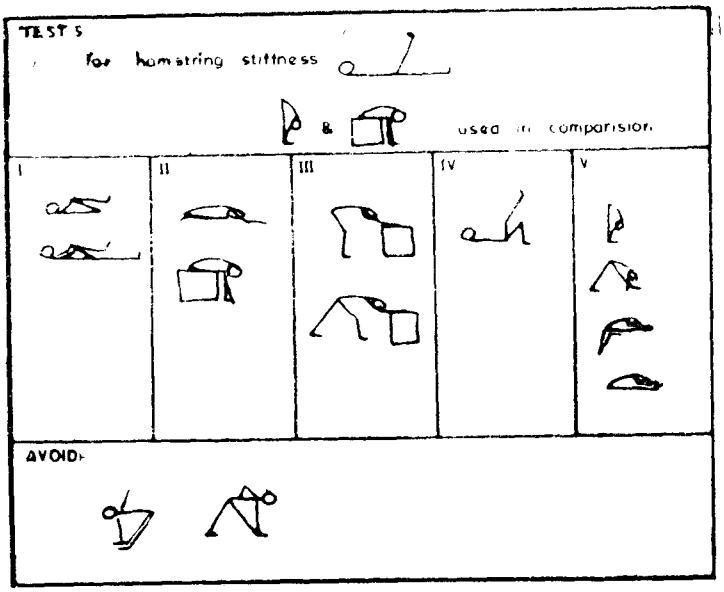
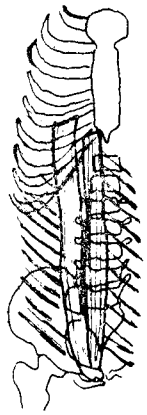



CHART 5



rectus abdominus
obliques

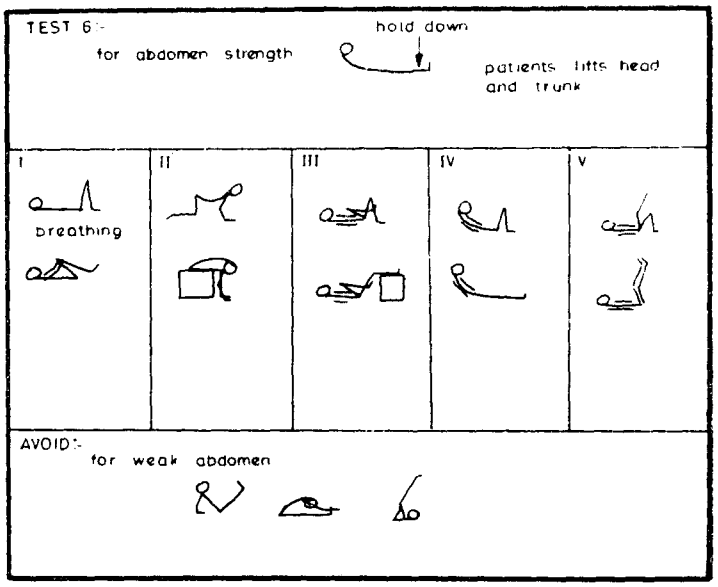
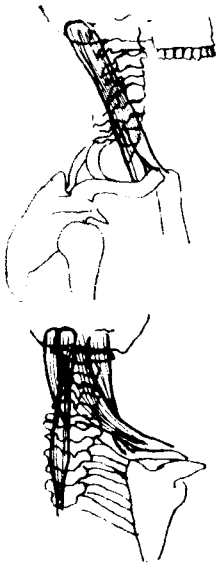
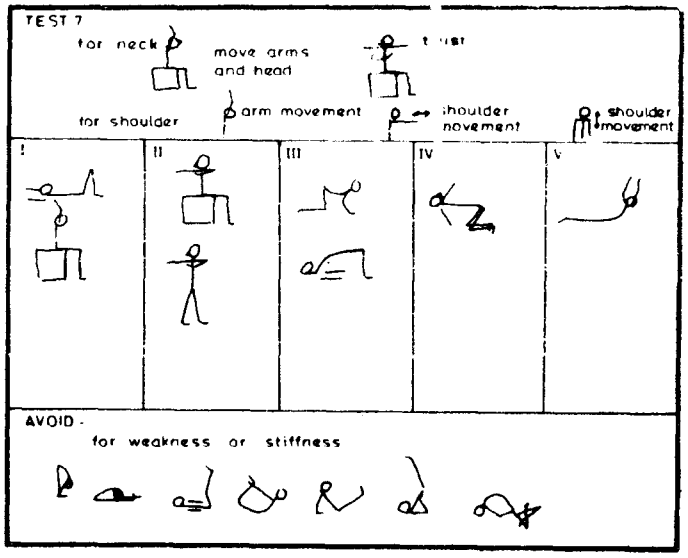



CHART 6






sternocleidomastoideus
trapezius
semi spinalis capitis
splenius capitis
splenius cervicis

CHART 7

1. Sit-ups are contraindicated in patients with acute and subacute lumbar pain and definitely not advisable for older patients.
2. Isometric abodminal exercises are preferable (being milder) to back extension exercises.
3. Deep knee bending places inordinate stress on the knee.
4. Toe touching and stiff leg raise do not relax the back but can put great strain on back muscles.

Once the list of asanas are determined from the set, the actual sequence is worked out on the principle of alternate pose and counter-pose. Let us consider a specific case of test result conducted on a male patient, 37 years old, 176 cm height, 60 kg weight, a professional executive. The test results from the Charts 1 to 7 is as follows :

| Tests | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Grade performed | II | I | II | I | I | I | I |
| Sequence recommended | 2 | 7 | 5 | 3 | 1 | (Repetition) | |

Since no asana in this sequence is contraindicated, the entire sequence is retained. Rest may be incorporated between 3 and 4 and after the completion of the asanas. Simple breathing schedules are carried out with the patient seated in a chair. The practice of prescribing gentle exercises coordinated with easy breathing for LBP patients whose muscles are in spasm finds support in White and Punjabi (1978) also. Variations in breathing pattern include long exhalation and holding breath after exhalation, the latter being particularly useful as an abdominal exercise. This then is the criteria for selection of an exercise schedule and a sequence buildup to be prescribed to a patient.

**4. Results and Discussion.**

A total of 16 persons between ages 22 and 60 were taken for testing and for therapeutic schedule. All patients had LBP without any pathology (testified by medical personal), with 5 out of 16 having LBP for more than 5 years. The sample consisted of 8 females (3 post-natal, 1 retroverted uterus, 2 age-related degeneration, 1 tension myocytis and 1 due to exertion) and 8 males (4 tension myocytis, 3 due to intense exertion, 1 gait related LBP).

The patients were interviewed individually during which the details of medical history, occupation, tension state, doctor's recommendations etc, were noted. Each patient is then examined on the basis of Charts 1 through 7 and the subjective reports, mobility of joints, location and intensity of pain etc., are noted. The sequence is built up on the basis of these tests as discussed earlier The course of therapy was usually 4 to 6 individual meetings once a week lasting about an hour. During each subsequnt visit, the improvements are noted and the exercise schedule is made progressively more demanding so that the muscle strength can be built up, thus incorporating a preventive aspect also in these schedules.

After a six month practice of asanas, a questionnaire was circulated to each patient to assess the changes brought about by the treatment.

Of the 16 people treated, 11 reported a significant lessening of LBP and the remaining 5 reported slight improvement with practice but recurrence of pain if practice is discontinued. Hence, regularity of practice is essential for the improvement in the condition.

The main points to conclude from the patient response after a six month followup is as follows :

1. Overwhelming majority (11 out of 16, nearly 70 percent) reported significant improvement in their conditions with near normal mobility and absence of pain.

2. Those who reported recurrence of back pain also reported irregularity of practice.

3. The assigned exercises on the basis of biomechnical computation is a safe method with easy introductory postures followed by those which worked with greater intensity on the back.

Several simple exercises derived from asanas have been analyzed in this study through principles of biomechanics so that an objective basis is provided fot assessing the activity of low back muscles during these postures. A series of test protocol has been worked out for testing the flexibility and strength of low back muscles. The patients can be tested with this protocol and the test results indicate the level at which this asanas may be prescribed, so that the back is not over-strained initially. Extension of these calculations to available rehabilitative techniques practiced elsewhere shows clearly the unsuitability of those which can be very severe on an already weak back. A clinical study on 16 patients through the present method of asana selection and progressive buildup has clearly shown that an overwhelming majority (about 70 percent) has a good recovery from low back pain.

Asana practices are characterized by slow movements, isometric muscle contraction and stretch of antagonist muscles The slow movements provide a low energy cost and hence fatigue is avoided. Isometrics are those in which the muscle is contracted under constant length; there is no movement of the joint, however since the muscle carries weight, work is done by it In cases of joint disarticulation it is still possible to keep the muscle active through the practice of isometrics. The muscle stretch has very important implications in muscle dynamics. Herein the muscle is both relaxed (reduced activity) and the feedback from the muscle is altered so that muscle control can be readjusted. For example, in cases of, say, spasticity, a readjustment of alpha motoneuron discharge is possible through changes in reflex response in a muscle during stretch. This modulation of motoneuron activity is not possible if the limb is

moved passively by the therapist. Further, the work done by the muscles can be increased through the introduction of breathing during asanas.

The asanas taught here are dynamic and with counterposes. Slow repetitive postures help to activate both the agonist and the antagonist during movement. Thus, sudden isometric work is not assigned to the muscle especially those which are weak due to disuse. Further, during slow movements the joints and the connective tissues are stretched gradually without extreme flexion and associated danger of damage. Movement also implies increased circulation and warming up of the muscles. Breathing in syncronism with movements (for example, slow exhalation during forward bending) add to the depth of movements. Breathing also indicates to the practitioner whether the physical limits of exercise is being reached when breathing becomes difficult or comes in spurts. It also puts more work on the muscle so that muscle tone improves.

Low Back Pain (LBP) is a wide spread malady afflicting more than 50 per cent of the population at any one time, in any country. The exercises suggested here are hopefully an improvement over the previous ones. However, intense investigation and long followup are required before *prescribing* any set of exercises based on asanas as final therapeutic regimen for low back pain.

**Acknowledgment**

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