# PAIN MANAGEMENT

## A Practical Guide for Clinicians

FIFTH EDITION

Chapter 20: New Concepts in Back Pain Management: Decompression, Reduction, and Stablization

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# Table of Contents

# 20

# New Concepts in Back Pain Management: Decompression, Reduction, and Stabilization

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## ABSTRACT

A thorough evaluation of previous traction techniques reveals no consistent pattern in prior literature. We have evaluated a variety of devices and found that seven major factors are important in achieving optimal clinical results. These include: (1) split table design to minimize effects of gravity; (2) flexion of the knees for hip relaxation; (3) controlled flexion of the lumbar spine during treatment which alters the location of distraction segmentally; (4) comfort and nonslippage of the pelvic restraining belt; (5) comfort and nonslippage of the chest restraint; (6) concomitant use of TENS, heat, ice, and myofascial release; and (7) a graduated limbering, strengthening, and stabilization exercise program. Using this system, successful pain control was achieved in 86% of patients studied with ruptured intervertebral discs and 75% of those with facet arthrosis.

## INTRODUCTION

New advances centering on the use of specific segmental distraction as an adjunct to managing low back pain with and without neuropathic sciatica are reported here. These should be of special interest to both primary care and multidisciplinary medical specialists when symptoms persist despite comprehensive management of acute back pain.

The utility of physical modalities has been well established in many forms (Wall & Melzack, 1984); however, the use of traction techniques has been largely empirical. Relatively few studies have specifically discussed ergonomics and the biomechanics of spinal pathology as it relates to practical clinical outcomes employing powered or weight distraction forms of therapy.

Previous outcome studies have lacked the applied principles of quantifications and biomechanics that correlated clinical data with a specific diagnosis resulting from structural abnormalities such as discal herniation, lumbar facet arthropathy, foraminal stenosis, and motion segment abnormality syndromes or their comorbid combinations (Anderson, Schultz, & Nachemson, 1968; Lind, 1974; Bettmann, 1957; Binkley, Stratford, & Gill, 1995). Anatomically, the low back is relatively clinically inaccessible.

A reevaluation of mechanical therapy is needed since the various etiologies have overlapping features. Different symptom complexes associated with dysfunction due to complex ipsilateral, contralateral, and segmental neural networking, as well as combined somatic and autonomic neural interactions, may serve to confound the clinician.

A novel approach to mechanotherapy is presented to review these six considerations: (1) outcomes validation, (2) relative safety, (3) ease of use by the patient or healthcare

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professional, (4) introduction of new principles of treatment, (5) appropriate utilization, and (6) cost effectiveness resulting in shortened morbidity with optimal improvement.

## TYPES OF LOW BACK PAIN

Classically, there are four broad categories of low back pain syndrome, each requiring different treatment pathways (O'Brien, 1984; Bogduk, 1987):

1. *Acute muscular low back pain* which is usually self-limiting
2. Acute low back pain involving sciatic radiation:
   A. With neurological dysfunction
   B. Without neurological dysfunction
3. *Chronic low back pain* which has recurring symptoms modified by therapy
4. Neoplastic low back pain syndrome which is recurring, but eventually becoming progressive, constant, and intractable

Each type of low back pain syndrome has common features which vary with the intensity of symptoms: (1) regional pain, (2) impairment and mechanical dysfunction exacerbated by activities of daily living, and (3) mood and behavioral changes. All need to be addressed for overall successful outcome.

## PRINCIPLES OF BIOMECHANICS

Mechanical traction is the technique of applying a distracting force to produce either a realignment of a structural abnormality or to relieve abnormal pressure on nociceptive receptor systems (Colachis & Strohm, 1969; Cyriax, 1950; Gray & Hosking, 1963; Judovich, 1954; Nachemson, 1966). Frequently, both problems co-exist in differing combinations, which generates a number of clinical concerns. Should treatment be constant or intermittent? What is the reasonable duration of treatment? Should gravity or a weight formula based on the patient's weight be utilized to determine the amount of force for the treatment? Can both mechanoreceptors and chemoreceptors that produce unwanted symptoms be integrated and harmonized?

It has been previously described that the distracting force must be greater than the specific pathophysiology causing symptoms, and these mechanisms must be individualized for each patient (Judovich, 1995). Caution not to exacerbate symptoms should always be exercised. The old maxim "no pain, no gain" is both passe and disingenuous. The magnitude of the force correlates with the amount of distraction and must be closely monitored. At what force do we obtain better and more successful results, while reducing costs and morbidity? Katz et al. (1986) reported that 25% of the body weight as a traction force applied to 15 degrees positive elevation from the parallel prone plane for a 14-day series was found to be effective. We differ in our findings, as will be reported below (Katz et al., 1986).

When successful, the patient clinically reports symptomatic improvement of well-being and objective clinical verification of (1) improved range of motion, (2) reduction of verifiable regional muscle spasm, (3) improvement in regional tenderness by evaluating health professionals, and (4) improved neuropathic signs when compared to pre-treatment findings. How can there be more individualized bioclinical integration?

Pathophysiology of regional low back pain syndromes varies on a highly personal, individualized basis in such factors as etiology, causation, resulting activity dysfunction, and psychopathological considerations. These factors must not be overlooked or underestimated in prescribing treatment.

## HISTORY OF TRACTION

A review of the "Annotated Bibliography on the History of Traction" (Appendix A) summarizes 41 articles, from Neuwirth, Hilde, and Campbell in 1952 to Engel, Von Korff, and Katon in 1996. The reader is referred to Appendix A for a review from medieval times to the present. A summary of this bibliography leads to the following conclusions:

1. Clinical outcomes are highly variable.
2. There are different types of traction techniques, such as intermittent or constant.
3. Variable angles of traction may be applied.
4. Differing weight sequences may be utilized.
5. Suspension devices are useful.
6. Time-scheduled sequences are described, but without specific guidelines and with many variables.

The present chapter is not intended to criticize the previous authors or data presented, but demonstrates that many variables being considered lack quantification. Neurological surgeons have gained extensive experience dealing with and managing problems of intracranial pressure using methods of quantification and have now applied those principles to the intradiscal pressure manometry for clinical correlation of low back pain syndrome.

The first application of quantification by relatively recent studies of quantitative intradiscal pressure changes has been reported by Ramos and Martin (1994). By cannulizing the nucleus pulposus of L4-5 and monitoring intradiscal pressure via a pressure transducer, three patients were observed to have lowered pressures below 100 mm Hg as a result of traction technique.

Other methods employing visualization were advanced by Gray (Gray et al., 1968). Radiological assessment of the

effect of body traction was reported by Gray et al. (1968). Using only the body's weight with a thoracic restraint and only a 12-degree incline, significant lengthening of the spine occurred within 5 minutes and even more significantly after this modified gravity reduction traction for 25 minutes.

Combined studies by Anderson, Schultz, and Nachemson (1968) of intervertebral disc pressures during traction demonstrated by radiographic studies concluded that disc space increases in height and lumbar disc protrusion can be reduced during traction. Myelographic evidence of disc herniation was found to disappear after traction (Anderson, Schultz, & Nachemson, 1968).

Shealy and Borgmeyer (1997) introduced a new biomedical application device that can apply all these positive effects to individual disc levels. To clinically document improvement, clinical data combined with radiofluoroscopy was employed. This new approach delivers precise treatment to decompress the lumbar disc space and then stabilize once asymptomatic through a program of physical rehabilitation.

## THE DRS SYSTEM

The major goal of the DRS System (Fig. 1) is decompression, reduction, and stabilization of the lumbar spine. In a series of 50 patients with chronic pain, 23 having ruptured intervertebral disc and 27 with facet joint pain, it was noted that *conventional* spinal traction was less effective and biomechanically insufficient for optimal therapeutic outcome. Extensive observations led to the conclusion that five major factors were important for lumbar traction efficacy:

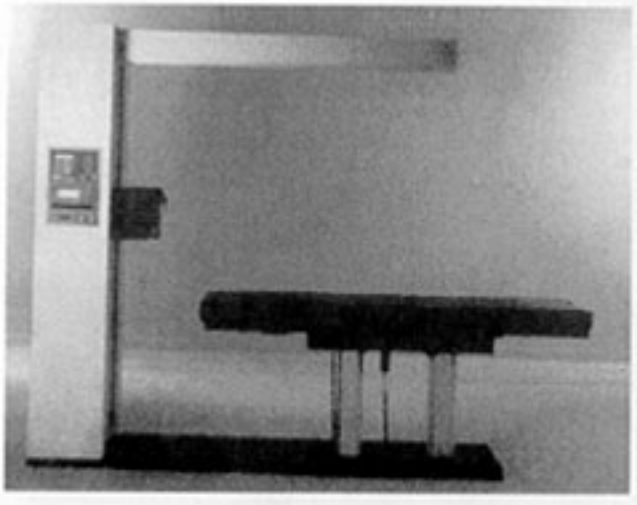

**Fig. 1.** The DRS™ decompression-reduction-stabilization device.

1. Separation of the lumbar component of the joint
2. Flexion of the knees
3. Flexion of the lumbar spine by raising the angle of distraction
4. Comfort and nonslippage of the pelvic belt
5. Comfort and nonslippage of the chest restraint

X-rays confirmed that significant distraction of the lumbar vertebrae required a weight of at least 50% of the patient's body weight (see Figs. 2 to 7). Thus, we have set the parameters of distraction to build up to 50% of the patient's body weight plus 10 pounds. The knees are flexed over a comfortable bolster that gives optimal relaxation. When the major focus of the patient's pain is at the L5-S1 intervertebral disc, no elevation of the pelvis is necessary. At L4-5, optimal focus of the distraction is obtained by raising the angle of distraction 10 degrees. For L3-4 or L2-3, an elevation of 20 degrees is generally optimal. There is enough variation in the normal lumbar lordotic curvature that manual palpation of the tension on the lumbar spine, as well as the patient's assessment of the focus of distraction, can help in making minor adjustments to these angles. With the DRS System, the distraction angle is accurately determined via a laser pointer to give precise angulation. The table on which the patient lies is divided with a smooth hydraulic component to separate the lumbar division as traction/distraction is applied. The traction/distraction is achieved with a computerized device that allows gradual build-up over a 2-minute period to the desired distraction force. Automatically, the optimal distraction weight is maintained for 1 minute, and then the pressure is reduced to 50 pounds for 20 seconds before the process repeats itself. The entire treatment process requires 30 minutes.

To minimize muscle spasm during the treatment, heat and a mechanical myofascial-release device providing alternating vacuum pressure to the muscles of the lumbar spine is applied for 30 minutes prior to the treatment. Immediately following the procedure, a cold pack is applied to the lower back for 30 minutes. The patient is then instructed in the use of a TENS unit applied to specific anatomical points to be used at home throughout the entire waking day until returning the following day for the next sequential treatment. The initial 2 weeks of this treatment program are done daily, Monday through Friday, followed by three times per week, for a total of 20 sessions.

Patients who are improving adequately by the end of the second week are instructed in a standard series of exercises for limbering, stretching, and stabilizing the lumbosacral and pelvic musculature. These exercises include a modified Williams' flexion exercise which involves raising actively the legs with the knees flexed and the hips abducted, flexing the ankle as far as comfortable toward the pelvis and the chest, alternately on each side. Patients


*Fig 2.* MRI, patient A, showing large ruptured intervertebral disc and L5-S1, pretreatment


**Fig. 3.** MRI, patient A, after 4 weeks of DRS. The ruptured intervertebral disc is approximately 50% reduced. Patient is free of pain and has marked improvement in mobility.

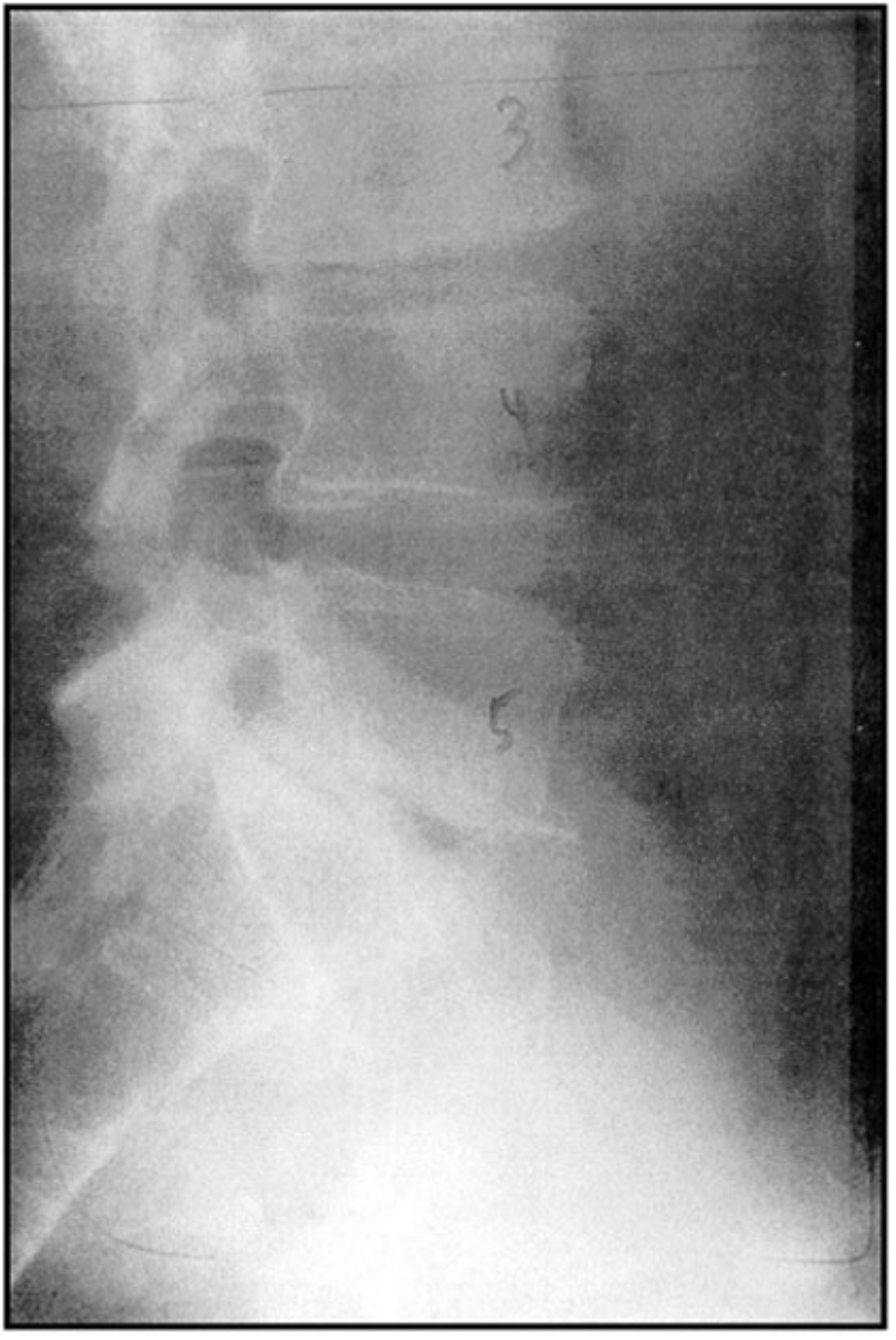


**Fig. 4.** Lateral lumbar x-ray, patient B, neutral position.

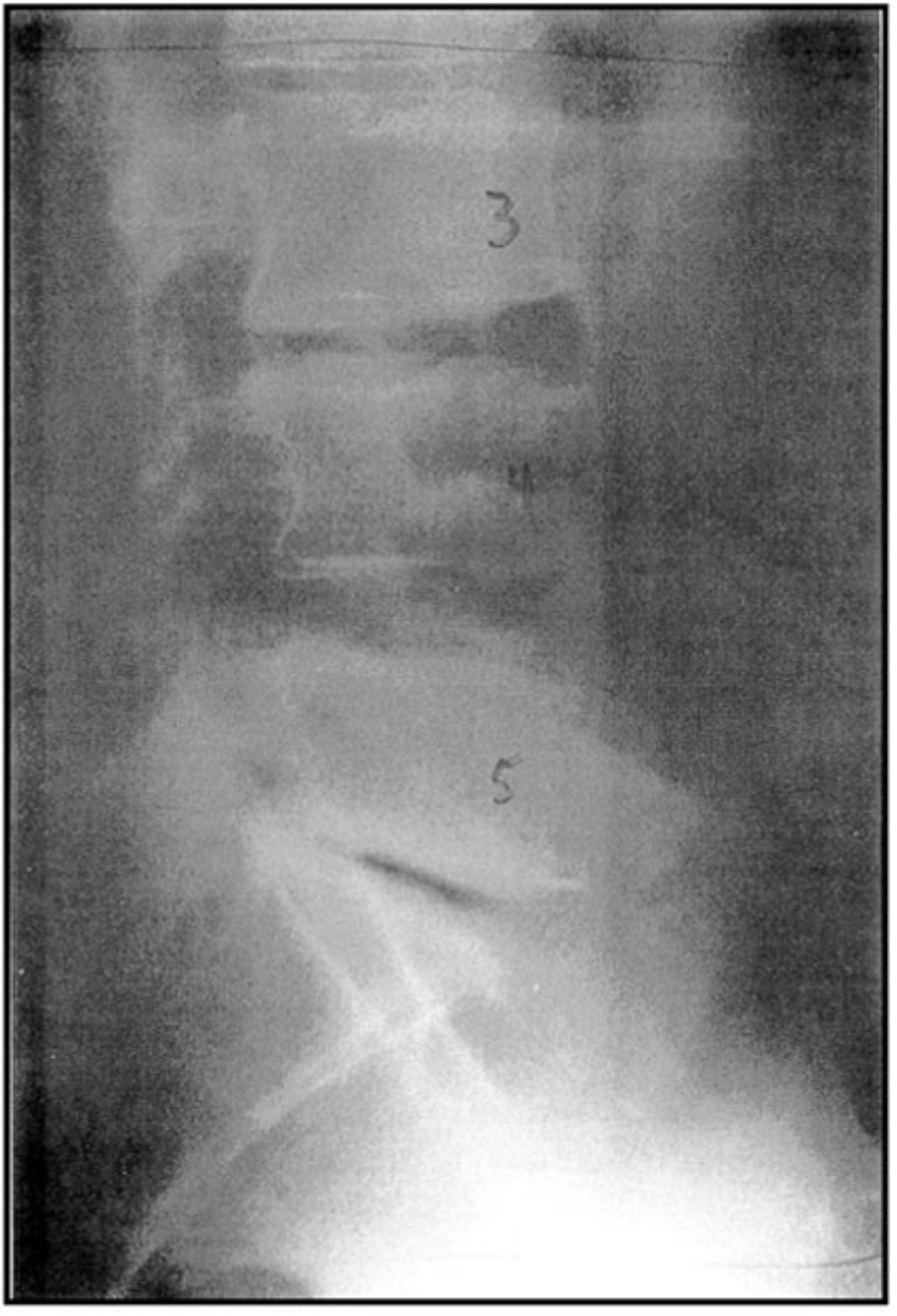


**Fig. 5.** Patient B, with traction-decompression, one-half body weight plus 10 pounds, knees bent.

**Fig. 6.** Patient C, neutral position, no traction, decompression.

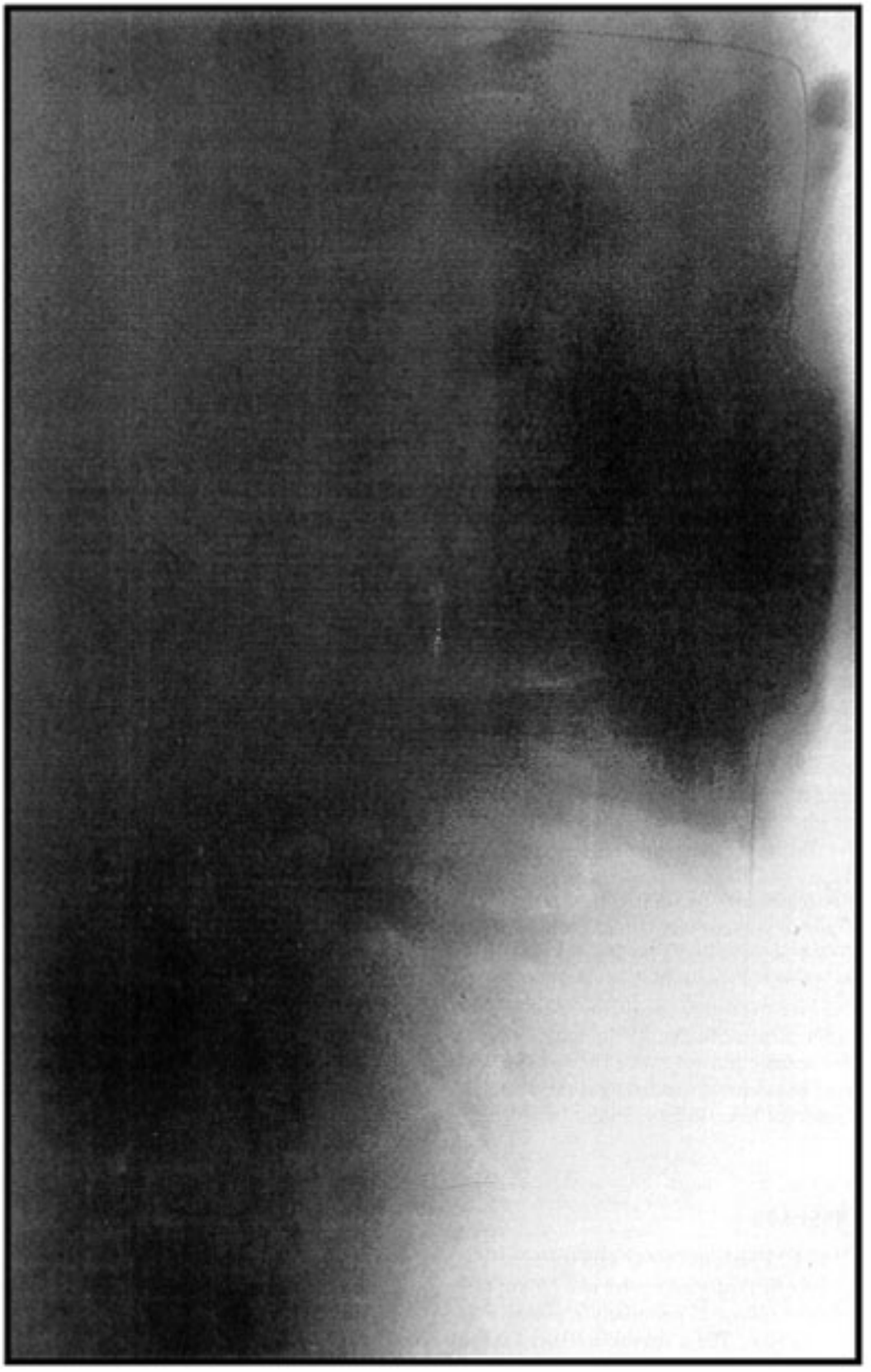

**Fig. 7.** Patient C, 30 degrees flexion, one-half body weight traction, decompression, resulting in increased widening of disc space, most prominent at L2-3 and L3-4.

are instructed in active exercises to rotate the left knee outward, while pulling it as strongly as comfortable toward the right axilla, then alternatively pulling the right knee toward the left axilla. At the maximum point of the exercise, the patient holds the described position for 30 slow breaths. Instruction is provided for exercises performed while supported on the elbows and simultaneously raising the extended legs 8 inches off the floor, followed by hip abduction, adduction, back to neutral, and finally lowering the legs to the floor. Patients start with 1 to 3 such exercises and build to 50 repetitions. When patients are capable of performing 50 repetitions, they begin slow sit-ups with their knees bent, starting with 1 to 3 repetitions and building up to 50 repetitions. Patients continue using the TENS device throughout the 4-week period. After the active treatment phase, patients are encouraged to continue with the TENS unit for an additional 3 months as they complete the limbering, strengthening, and stabilization exercises. The complete protocol for selection and exclusion criteria regarding patients is included in Appendix B.

For patients with ruptured intravertebral discs who have not experienced significant improvement or at least a 50% reduction in their pain level after five DRS sessions (1 week), addition of colchicine is helpful; 1 mg of intravenous colchicine, with 2 g of magnesium chloride and 100 mg of vitamin B6, is administered daily for 5 days (Appendix C). If significant improvement occurs during the 5-day colchicine treatment, then the patient continues with the DRS System and continues to take oral colchicine (0.6 mg daily) for 6 months, along with magnesium oral spray (allowing at least 200 mg of magnesium for sublingual absorption daily).

As an anti-inflammatory, we concentrate upon the use of bromelain proteolytic enzyme, 1,000 mg 30 minutes prior to each meal and at bedtime (Seligman, 1962; Lotz-Winter, 1990). If this is not sufficient, the patient may take any desired over-the-counter nonsteroidal anti-inflammatory drug (Benedetti & Butler, 1990). Obviously, patients often choose these and use a wide variety. The major complications of nonsteroidals include gastric erosion/ulceration and potential liver, kidney, and/or bone marrow toxicity.

## CLINICAL RESULTS

In our study, 19 of 23 patients (86%) with ruptured intervertebral discs were markedly improved, and 75% of those with facet arthrosis (20 of 27) similarly reported a 50–100% reduction in pain. These results are based upon a pain analog scale with patient evaluation before and no later than 1–4 weeks after completion of therapy. All patients with pain reduction of 50–100% showed improvement in flexibility and total physical activity.

## CONCLUSION

A thorough evaluation of the literature reveals no clinical outcomes to correlate with different techniques. In our review and experience, no single device incorporates all seven major factors that are important in achieving clinical results. These include: (1) split table separation; (2) flexion of the knees; (3) flexion of the lumbar spine to raise the angle and distraction segmentally; (4) comfort and nonslippage of the pelvic restraining belt; (5) comfort and nonslippage of the chest restraint; (6) concomitant use of TENS, heat, ice, and myofascial release; and (7) a graduated limbering, strengthening, and stabilization exercise program. Using this system, successful pain control is achieved in 86% of patients with ruptured intervertebral discs and 75% of those with facet arthrosis.

Because of space constraints, we did not discuss the psychological and psychiatric management of pelvic pain technique, and the reader is referred to other sources.

It is worthwhile to consider also that by alternating the pathophysiology of the macro-mechanoreceptor–pain pathway, we may secondarily affect the chemoreceptors as well as reduce noxious stimuli of the richly enervated somatoautonomic lumbar spine, thereby reducing the chronicity of activity-related lumbar pain syndrome. This benefit may also reduce need for medications.

The new DRS System is a welcome addition to the problematic low back pain syndrome. The DRS System appears to be cost effective; it merits more widespread utilization and awaits additional ergonomic studies. This approach can provide pain relief, and physicians are invited to take advantage of this gratifying treatment approach.

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## APPENDIX A: ANNOTATED BIBLIOGRAPHY ON THE HISTORY OF TRACTION

Anderson, G. B. J., Schultz, A. B., & Nachemson, A. L. (1968). Intervertebral disc pressures during traction. *Scandinavian Journal of Rehabilitation Medicine, Suppl. 9,* 88–91.

Pressures in the third lumbar discs were measured in individuals during active and passive traction. During active traction, an increase in pressure was always recorded, with larger increases corresponding to larger traction forces. During passive traction, the pressure remained close to the resting pressure, sometimes increasing and sometimes decreasing slightly.

An advertisement for something called a Back-A-Traction, a Swedish gravity traction table, currently being sold for $995 (which is similar to an ad from 1978), states: "The unique feature of Back-A-Traction is a sliding backrest. You will experience an unloading of pressure from your joints and vertebrae even at an angle of 15 degrees." At 30 degrees, the traction is greater. The author states that the traction "relieves the pressure on pinched nerves and gives the vital fluids free access to lubricate your joints, helps align your pelvis and correct spinal curvatures, improves blood circulation, etc."

Bettmann, E. H. (1957). Therapeutic advantages of intermittent traction in musculoskeletal disorders. *GP, XVI*(5), 84–88.

Treatment was directed at 210 patients with intermittent traction; 190 derived good results, with only 38 requiring some additional treatment. Sixteen of the 190 who did well required subsequent treatment after 3–6 months. In no case was any harmful effect observed. The author even reports improvement in patients with arthritis of the knees and hips, as well as stiff shoulders. Weak and constant pull was found to be ineffective, and strong and constant pull led to ligamentous overstretching and neurovascular tension, but intermittent gradual increasing pull, with complete relaxation and maximum traction, restored anatomic and physiologic equilibrium. Contraindications were inflammation, infection, acute arthritis, trophic changes with disc protrusion, acute torticollis, myositis, and cases which respond to the first treatment with increasing pain. For lumbar traction, the author reports that elevation of the patient's legs with flexion of the knees or supporting them at an angle of 45 degrees gave much more comfort. The average treatment was 30 minutes. Only 50 pounds of pressure was used in the lumbar spine.

Binkley, J., Strafford, P. W., & Gill, C. (1995). Interrater reliability of lumbar accessory motion mobility testing. *Physical Therapy, 75*(9), 786–795.

In 18 subjects with low back pain, six different "orthopedic physical therapists" evaluated posterior-anterior accessory motion mobility at each of six levels, L1 to the sacral base, with the mobility being recorded on a nine-point scale. There was only 69% intraclass correlation coefficients. Conclusions are: "There is a poor interrater agreement on determination of the segmental level of a marked spinous process. There is poor interrater reliability of P-A accessory mobility testing in the absence of corroborating clinical data. Caution should be exercised when physical therapists make clinical decisions related to the evaluation of motion at a specific spinal level using P-A accessory motion testing."

Bogduk, N. (1987). Pathological anatomy of the lumbar spine. *Clinical anatomy of the lumbar spine.* New York: Churchill-Livingstone.

Bogduk defines mechanical disorders of the lumbar spine as follows.

**Acute locked back**: "A painful condition of sudden onset that occurs during attempted lifting." This pain is eased by flexion and aggravated by straightening.

**Zygapophysial joint mechanism**: He considers this meniscus entrapment, which is capsular traction, which may include a fibro-adipose meniscoid tissue which fails to re-enter the zygapophysial joint cavity after some type of movement. In such a case, "the meniscoid impacts the margin of the articular process and enters the subcapsular recess at the upper or lower pole of the joint." Again, flexion reduces impaction. He points out that fragments of articular cartilage resembling the meniscoids may be formed in these joints and a plate of cartilage may be torn and moved.

**Intervertebral disc mechanisms**: Another cause of an acute locked back might be posterolateral extrusion of disc nuclear material along a fissure in the posterolateral annulae.

**Lumbar disc herniation**: Expulsion through the annulus fibrosa of some portion of the nucleus pulposus. He comments that disc protrusion and disc prolapse are "sometimes used in relation to this phenomena—to imply subtle differences."

He describes end-plate fractures, with vertebral end plates being more prone to fracture than failure of an annulus fibrosus. They are considered a "normal feature of aging and degeneration."

**Disc degradation**: The mechanisms by which disc degeneration or degradation become symptomatic are additional stresses

on the annulus fibrosus during weight bearing and flexion and arthrosis of the zygapophysial joint.

Braaf, M. M., & Rosner, S. (1960). Chronic headache: A study of over 2,000 cases. *New York State Journal of Medicine, 60,* 3987–3994.

Braaf and Rosner consider that lesions of the cervical spine are one of the principal causes of persistent headache, chronic headache of cervical origin is a referred symptom caused by compression or irritation of one or more cervical nerve roots or portions thereof, trauma to the cervical spine is the prime factor in producing cervical nerve root irritation, and headache can be treated successfully by cervical traction. They state that 80% are completely relieved on a permanent basis with traction. Another 15% obtain satisfactory relief to carry on normal existence with this approach. They consider cervical traction specific for headache of cerebral origin and by far the most effective method, and maximum benefit is obtained only when it is carried out in a supine position. Traction should be performed as an office procedure, with treatment continued at least 3 months.

Braaf, M. M., & Rosner, S. (1963). The treatment of headaches. *New York State Journal of Medicine,* March 15, pp. 687–693.

"In chronic headache definite, physical signs have been found consistently in the neck. Localized cervical tenderness, spasm of the muscles at the back of the neck, and restrictive movements of the neck are the most common physical findings...especially pronounced during the headache phase." A wide variety of abnormalities of the cervical spine, including tenderness all the way down to the base of the lower cervical spine, is seen. There are often motor, sensory, and reflex changes in the upper extremity. Major radiologic findings of the cervical spine are "usually very definite," especially on lateral films, both with the patient in neutral and with the head hyperextended, "similar to those found in lesions of the cervical disks." There is often loss of lordosis, narrowing of intervertebral spaces, osteophytic growths, and narrowing of intervertebral foramina, but at least loss of normal cervical curve is very consistent.

The best treatment in these authors' opinion is a combination of head traction and an intramuscular injection of 200 mg of thiamin chloride. Thiamin chloride gives poor therapeutic results, but the addition of thiamin chloride to head traction makes the head traction more effective. Treatments "may have to be carried out daily, for the first week" and then three times a week for up to 2–3 months. "It has been demonstrated conclusively that head-traction, to be effective, must be carried out in the supine position." Sitting or standing traction often makes the patient worse. "The position of the head can be varied according to the angulation of the cervical curve" found on x-ray. That is, they change the angle to optimize normal lordosis. They use 5–60 pounds of weight, but never more than is comfortably tolerated. They begin with 5–10 pounds and gradually increase the weight. Aggravation of pain indicates too much force. They obtained complete alleviation of headache in 60% of patients, good results in an additional 30% (that means over 90% improvement), and poor results in only 10%. For migraine, figures are "slightly less favorable" and therapy takes longer, but they still consider this quite remarkable. They have found this type of head traction therapy effective in Horton's cephalgia, idiopathic headache, posttraumatic (postconcussion) headache, tension headache, psychogenic headache, headaches due to temporal arteritis, atypical trigeminal neuralgia, sphenopalatine neuralgia, headaches due to cervical arthritis, and Meniere's syndrome.

Interestingly, the researchers reported that intranasal sphenopalatine ganglion block with 2% pontocaine helped, "even though this therapy never resulted in complete alleviation of the headache." They report that injection of 2% pontocaine hydrochloride in the upper cervical region is effective in relieving headaches in most cases, but results unfortunately are only temporary. Injection of 10 cc of 1% procaine intravenous over a 2- to 3-minute period was repeated, with dramatic results in 100 consecutive cases. Exercise of neck muscles essentially maintains the improvement obtained in traction because the muscles are markedly weak. "Exercises are directed toward strengthening muscles at the back of the neck as well as muscles of the shoulder girdle." Diathermy and massage of the muscles are often helpful as well. They emphasize that the diagnosis of psychogenic headache is inappropriate, since many of these patients are cured with this type of treatment.

Braaf, M. M., & Rosner, S. (1965). More recent concepts on the treatment of headache. *Headache, 5,* 38–44.

"Cervical traction is the most effective method, not only for giving symptomatic relief, but also for preventing the occurrence of headache on a permanent basis....Chronic headache can be prevented by early recognition of the cervical lesion as a cause of the headache followed by adequate treatment directed towards the cervical spine."

Burton, C., & Nida, G. (1976). *Gravity lumbar reduction therapy program.* Minneapolis: Sister Kenny Institute.

In 1972, Dr. Burton started using a type of traction by a canvas chest harness, which he designed, in which he "hung" daily for 10 days a patient with a classic ruptured disc at L5-S1. This became the basis for gravity lumbar reduction, with the patient tilting upright in a chest harness, with the body's weight hanging below that from 30 degrees to 90 degrees. The harness was designed to have its lowest strap tightened under the rib cage and the upper straps grasp the rib cage to effect an equal distribution of pressure. They built up to a total of 4 hours of hanging traction per day and said that anything less than 4 hours with a minimum of 40 degrees elevation of the body was inadequate. They continued such treatment for 1–4 weeks, with those with ruptured discs being maintained an average of 10–14 days. The most significant complication was intolerance because of increased pain or a drop in blood pressure. They stated that the greatest value was when there was low back pain with sciatica due to a ruptured disc.

Colachis, S. C. Jr., & Strohm, B. R. (1969). Effects of intermittent traction on separation of lumbar vertebrae. *Archives of Physical Medicine & Rehabilitation, 50,* 251–258.

Ten subjects (from 22 to 25 years of age) were placed in the supine position with the thighs flexed 70 degrees and legs parallel to a split traction table. They used an angle of rope pull of 18 degrees and a traction force of 50 pounds applied for 10 seconds, followed by a rest period of 5 seconds, with traction given intermittently for 15 minutes. After a rest period of 10 minutes, a 100-pound traction force was applied in the same manner for 15 minutes intermittently, and after another rest period of 5 minutes, another 100-pound traction force was applied continuously for 5 minutes. Lateral radiographs were taken before, during, and after the application of the traction force. There was a statistically significant increase in total mean posterior vertebral separation with 50 pounds of traction force and a significant increase in total mean anterior and posterior

separation when a traction force of 100 pounds was applied. The greatest increase in posterior vertebral separation during traction occurred at the L4-5 and the least at the L5-S1 interspace with this particular approach with the rope at 18 degrees, but it is worth noting that there were changes all the way to T12-L1. For instance, at 100 pounds of intermittent traction, there was an increase in the posterior vertebral separation at T12-L1 of 0.7 mm, 0.4 at L1-2, 1.5 at L2-3, 1.4 at L3-4, 1.55 at L4-5, and 0.1 at L5-S1, an actual total elongation of the entire lumbar spine of 4.95 mm. With continuous traction of 100 pounds for 5 minutes after 5-minute rests, the mean total was still 5.25 mm longer than prior to the traction.

Cyriax, J. (1950). The treatment of lumbar disc lesions. *British Medical Journal*, December 23, 1434–1438.

Cyriax states, "Sustained traction is the method of choice for ambulant patients with pulpy herniations whose symptoms warrant treatment. Distraction at the affected joint has two effects. (1) Increase in the interval between the vertebral bodies, thus enlarging the space into which the protrusion must recede. (2) Tautening of the joint capsule. Naturally, when the slack is taken up, the ligaments joining the vertebral bodies exert centripetal force all around the joint; this tends to squeeze the pulp back into place. Thus, sustained traction merely represents a way of achieving in a very short time the same effect as rest in bed for some weeks."

Bands around the mid-chest and pelvis with 200–300 pounds of pressure were applied for 2–3 periods of 20 minutes each, with 5 minutes rest in between. Treatment was carried out daily until the patient was well, usually 1–2 weeks. Sustained traction was described as using "the greatest possible traction" that the patient will permit for "as long as is reasonable."

Cyriax, J. H. (1955). Discussion on the treatment of backache by traction. *Proceedings of the Royal Society of Medicine, 48*, 805–814.

Cyriax mentions that some people do better prone and some supine. Patients were treated once or twice a day for half to one hour each time. Traction weight may be only 100 pounds with a "small woman," but up to 200 pounds in a "large man." He emphasized, "As soon as the traction becomes effective, certain alterations in the pain are felt by the patient." The changes are that the pain usually ceases, but a unilateral lumbar pain may become central, a root pain may become a lumbar pain, a root pain may shorten (that is, move from the calf to the thigh above it), a root pain may remain in the same place but become less intense, or the pain may remain unaltered.

He emphasized that the patient must be treated daily; otherwise, it is not worth doing. He abandons treatment if pain is not improved after 12 sessions, and treatment is continued up to at least 4 weeks if necessary. In some patients with constant backache, adequate therapy may require 2–3 months.

The indications, in his opinion, are a protrusion of a disc, failure of manipulation, impaired nerve conduction (a weak muscle, absent ankle jerk, or cutaneous analgesia), failure of epidural local anesthetics, reference of pain to the coccyx or genital area, first and second lumbar disc lesions, and recurrence of pain after laminectomy. He considers contraindications to traction as "purely annular displacements," painful are during trunk flexion, pain caused by side flexion away from the painful side, pain which ceases as soon as the traction is applied but increases significantly when traction is released, and patients with impaired cardiac or respiratory function.

Deets, D., Haupt, K., & Haupt, S. S. (1977). Cervical traction: A comparison of sitting and supine positions. *Physical Therapy, 57*(3), 255–261.

These authors also feel that a supine position is much more effective than a sitting position. There is greater posterior intervertebral separation, increased relaxation, decreased muscle guarding, and increased stability, with less force needed. Deep heat and massage prior to traction was recommended. They measured separation of the disc space in the same subjects sitting and supine, using 30 or 40 pounds of weight, and they got greater increase in interspace measurement in the supine position.

Dettori, J. R., Bullock, S. H., Sutlive, T. G., Franklin, R. J., and Patience, T. (1995). The effects of spinal flexion and extension exercises and their associated postures in patients with acute low back pain. *Spine, 20*, 2303–2312.

Subjects (149) with acute back pain were given flexion exercises, extension exercises, and postural extension exercises. There was no difference in outcome between flexion or extension exercise groups. However, either exercise was slightly more effective than no exercise.

Engel, C. C., Von Korff, M., & Katon, W. J. (1996). Back pain in primary care: Predictors of high health-care costs. *Pain, 65*(2,3), 197–204.

The authors studied 159 back pain patients consecutively presenting in a primary clinic of an HMO. Their conclusion is that a minority of primary care back pain patients account for a majority of healthcare costs. Increasing chronic pain was the strongest independent predictor of high back pain costs. Increasing pain persistence and a disc disorder with or without sciatica were also significantly predictive of high back pain costs. Arthritis was weakly associated with high cost variables, compared to nondisc, nonarthritis pain. Increasing depression was weakly but not statistically associated with high back pain costs. They quote other statistics suggesting that the etiology of back pain is unclear in at least 79% of men and 89% of women. Only 2% of patients ultimately require surgery, and only 16.9% have a disc disorder and/or sciatica. They emphasize, "Often, however, prescribed therapies such as bed rest, opioid analgesics, and muscle relaxants or sedatives do not reliably ameliorate chronic pain and may acutely diminish patient functioning."

Goldish, G. D. Lumbar traction (source of this book undetermined).

Among other things, the author states that no significant distraction of the lumbar disc was produced at less than 50 pounds of traction. He mentions that Cyriax has hypothesized that traction could actually produce negative intradiscal pressure, strong enough to suck the herniated disc back in.

Gose, E. (1996). *Clinical study...The efficacy of VAX-D therapy.* Chicago: University of Illinois, April 10.

The author states that 20 treatments of VAX-D therapy have been proven to be effective in about three-quarters of all patients who have any combination of facet syndrome, degenerative disc, or single disc herniation.

Private transmittal. On April 12, 1978, the senior author received a package from Gravity Guidance, Inc. (816 Union, Pasadena, California). The material discussed an inversion gravity system where people were hung upside-down by the ankles. The following are statements from these materials:

"Realign vertebrae, correct internal derangement — visceral, vascular, and skeletal, relieves pressure on nerves and articular sur-

faces. Permits the protrusion of the disk to be drawn back and heal in the proper position. Sucks the nucleus to a more central position—away from the sensitive posterior part of the annulus. Pulpy protrusions are reducible by full body load. Increases the range of motion and joint play. Distributes pressure equally in all directions and dissipates force. Decompresses the body (SPINE). Increases the volume capacity of the nuclear space (disk). Reduces degenerative changes in the disk and bone." Attached to that is mention of a patent number, 3,380,447.

Gray, F. J., & Hosking, H. J. (1963). A radiological assessment of the effect of body weight traction on the lumbar disc spaces. *The Medical Journal of Australia*, December 7, 953–955.

These authors used a traction table with the patient supine. The thoracic harness holds the body as the table is tilted a foot down, so the patient's body is really doing the traction. They used only a 12-degree incline, and after 85 minutes they noticed that even a higher angle of 70 degrees gave no significant further lengthening, but 5 minutes at 12 degrees was quite significant. These results indicate that "compared with the horizontal supine position, the lumbar disc spaces were widened significantly at an incline of 12 degrees after traction for 5 minutes, and even more significantly after traction for 85 minutes."

Gupta, R. C., & Ramarao, M. S. (1978). Epidurography in reduction of lumbar disc prolapse by traction. *Archives of Physical Medicine & Rehabilitation, 59*, 322–327.

Fourteen patients, 7 of whom had multiple disc protrusions and the others a single disc protrusion, were treated for 10–15 days with traction applied by bilateral skin traction with a heated plaster on both sides, with 60–80 pounds of weight and the foot of the bed elevated 9–12 inches. Patients with massive disc prolapse tolerated the heavy skin traction better than those with less protrusion. Ten of the 14 patients showed definite clinical improvement, with decrease in back pain and sciatica, normal straight leg raising, and complete or partial recovery of sensory deficit. In all these cases, the lateral epidurograms revealed normal anterior contrast column, and the PA epidurogram showed no defect in nine cases, showing that the disc had reduced to its normal position. In one case, although there was definite clinical improvement and decrease, there was still a slight persistent defect. Two patients with motor deficits showed improvement. In two cases, only minimal improvement in clinical condition occurred after the traction, and, interestingly, their epidurograms showed persistence of the same defects. They showed an average vertebral distraction during traction of 0.5 mm. The authors followed nine of the cases for 1–2 years with no recurrence of symptoms.

Hadler, N. M., Carey, T. S., Garrett, J., & the North Carolina Back Pain Project (1995). The influence of indemnification by workers' compensation insurance on recovery from acute backache. *Spine, 20*, 210–215.

Of 1,633 patients seen, 505 were insured by workers' compensation. These 505 were compared with 861 who had been employed on any job for pay within 3 months of the onset of backache, but whose care was not underwritten. "Those with compensable back pain were more likely to categorize their tasks as physically demanding and had taken more time off work in the month before the baseline interview. Recovery of the sense of wellness they enjoyed before the episode of back pain was delayed. Recovery of function or return to work was not delayed." The conclusion: "Each of these associations is a reproach to the fashion in which workers' compensation insurance for regional back pain serves the ethic that is its raison d'être."

Hirschberg, G. G. (1974). Treating lumbar disc lesion by prolonged continuous reduction of intradiscal pressure. *Texas Medicine, 70*, 58–68.

The author mentions treating several hundred patients with sciatica resulting from lumbar disc lesion. Conservative treatment usually consisted of bed rest and pelvic traction. There are no real details about traction, and he really emphasizes prolonged bed rest.

Hood L., & Chrisman, D. (1968). Intermittent pelvic traction in the treatment of the ruptured intervertebral disk. *Journal of the American Physical Therapy Association, 48*(1), 21–30.

"The present survey indicates that intermittent pelvic traction is of value in treating the patient with a ruptured intervertebral disk...The patient with a nerve root compression from above and list away from the affected side would be expected to have the best results." One year or more later, they presented excellent results in 15%, good results in 52.5%, and poor results in 47.5%. Excellent meant asymptomatic and employed full-time; good meant symptoms greatly improved with occasional minor low backache and fatigue.

The treatment consisted of heat with hydrocollator packs or ultrasound, followed by intermittent pelvic traction. The patient was placed on a traction table with the legs raised to flatten the lumbar spine. They used a canvas traction belt around the pelvis and a thoracic corset around the rib cage to restrain the upper body. Traction force was most frequently set at 65–70 pounds, although initial treatments were usually given at 55 pounds.

Interestingly, they show a photograph from 1544 with an accrued traction table with the patient being hanged from above. This looks very much like what Chuck Burton did. They quote Neuwirth et al., in which up to 220 pounds of traction was used. Judovich, back in the 1950s, presented a new method of intermittent traction, and he stated that a constant pull was intolerable to the average patient, but intermittent traction could be tolerated and would give improved results. Cyriax, as early as 1950, also suggested that sustained traction gave much more effective results than bed rest. Cyriax used 200–300 pounds of pelvic traction for two or three periods of 20 minutes, with 5 minutes of rest between periods, given daily for up to 2 weeks. Cyriax stated that traction "creates an increased space between the vertebrae, permitting the return of the prolapsed material." He also stated that the tightened ligaments helped to squeeze the protrusion back in place. The authors also report a study by Chrisman et al. on patients with back pain, sciatica, and a positive sciatic nerve stretch test with either weakness or loss of a tendon reflex; 51% of the patients had good or excellent results with traction.

Judovich, B. D. (1954). Lumbar traction therapy dissipated force factors. *Lancet, 74*, 411–414.

In the cervical area, this author reported that it required 30–40 pounds to demonstrate a beginning widening of the intervertebral spaces. In the lumbar spine, he used 80–85 pounds of traction in most people, but at least 90 pounds or more in heavier patients. Keeping the bed level, he found that raising the legs in slings during the traction helped significantly. Even in heavy patients, it required 10 pounds less traction if the legs were flexed over a firm bolster. Hyperextension increases pain. Flexion of the spine decreases pain and improves results. In both live people

and cadavers, "the average surface traction resistance of the body is approximately 54% of total body weight. The lower body segment—transverse section through L3, L4 interspace—weighs approximately 48% of total body weight. Approximately 54% of the weight of the lower body segment is also required to overcome its surface traction resistance. This is equal to approximately 26% of the total body weight. The force, therefore, that is dissipated with leg or pelvic traction is approximately 26% of the entire body weight. Only adequate weight in excess of this amount has a stretch effect upon the lumbar spine."

Judovich, B. D. (1995). Lumbar traction therapy—Elimination of physical factors that prevent lumbar stretch. *Journal of the American Medical Association, 159*(6), 549–550.

The author emphasizes that in a living being, the force necessary to overcome "surface traction resistance" is approximately 54% of the weight of the body. "Tone and elasticity of tissues appear to have no practical bearing upon the required force." Interestingly, he emphasizes that the lower body from the L3-4 interspace composes 49% of the entire body weight; thus, 26% of the entire body weight is calculated as an approximate average necessary to overcome resistance of the lower half of the body. This is called the "dissipated force factor." This particular force is "completely neutralized and lost as a stretch force to the lumbar spine." He emphasizes thus that the first 40–45 pounds are "lost" as a lumbar stretch force. Thus, he emphasizes further that one must exceed an average of 80 pounds of weight in order to begin to produce any type of effective lumbar traction.

Lawson, G. A., & Godfrey, C. M. (1958). A report on studies of spinal traction. *Medical Services Journal of Canada, 14*, 762–771.

These authors used spinal traction with weights up to 100 pounds on the cervical area and 150 pounds on the lumbar region for varying amounts of time and showed increases of up to 4 mm with the disc spaces in the lumbar area.

Lehmann, J. F., & Brunner, G. D. (1958). A device for the application of heavy lumbar traction: Its mechanical effects. *Archives of Physical Medicine & Rehabilitation, 39*, 696–700.

These authors describe a hydraulic device that delivers heavy lumbar traction in an upright position. They state that "under traction the proper alignment of the vertebrae of the lumbar spine is maintained. The machine produced a statistically significant widening of the intervertebral spaces and a therapeutic stretch of the lumbar musculature."

Lidstrom, A., & Zachrisson, M. (1970). Physical therapy of low back pain and sciatica. *Scandinavian Journal of Rehab Medicine, 2*, 37–42.

In 62 patients treated with sciatica, use of intermittent traction as recommended by B. Judovich in 1954, using one-half of the body weight plus an additional 30–40 pounds of intermittent traction, revealed a "statistically significant priority" for those treated with traction an average of ten times. In addition to the pelvic traction, they treated patients with "isometric training of the abdominal muscles." They used the Fowler position for the traction. Actually, the traction force was in general given over a 20-minute period with 4 seconds of hold and 2 seconds of rest. The traction force used for a patient weighing 50 kg was 58 pounds; for one weighing 55 kg, 61 pounds; for one weighing 60 kg, 63 pounds; and for one weighing 70 kg, 69 pounds. Basically, they had improvement in 100% of those treated with traction.

Lind, G. (1974). Auto-traction: Treatment of low back pain and sciatica. Dissertation. Sweden: University of Linkoping.

Radiographic studies performed during traction have demonstrated that the disc space increased in height and that lumbar disc protrusion was reduced. Myelographic evidence of disc herniation was found to disappear after traction.

In active traction, the subject's pelvis was fitted with a harness attached to a solid metal frame. The subject applied traction by pulling with the arms on another frame at the head end of the table. The pressure is exerted by the patient. They called this auto-traction. Patients were all lying on their left side when this was done. Passive traction was produced by two investigators, one pulling on the patient under the arms and the other on the pelvis. No specific weights in either case were listed.

Loeser, J. (1996). Editorial comment: Back pain in the workplace. II. *Pain, 65*(1), 7–8.

Dr. Loeser reports that "malingering is rare, delusions of pain even rarer." He further goes on to state that 80% of the adult population has back pain at some time or another, and at any one time 14% have had back pain in the previous 2 weeks. Loeser states that the overwhelming majority of those who do submit a claim for their back pain return to work within a few weeks, but that there are two million chronic disabled back pain patients in the United States. "There is increasing evidence that the treatments rendered to those with nonspecific back pain have no efficacy." Loeser emphasizes that the rate of surgery for low back pain is directly related to the number of surgeons and not to the population. He also wagers "that the number of chiropractic treatments is related to the number of chiropractors, not citizens." He goes on to say that the same could be said for acupuncture treatments, physical therapy, or any other treatments for low back pain. "Health care is a social convention, driven only in small part by anatomy, pathology, or physiology." He believes that "a good argument can be made that our current method for diagnosing, treating, and compensating claimants with nonspecific low back pain leads to increased pain, suffering, impairment, disability, and costs. Patients are told things by their doctors that lead to inactivity and depression."

Mathews, J. A. (1968). Dynamic discography: A study of lumbar traction. *Annals of Physical Medicine, IX*(7), 265–279.

These authors describe the radiographic findings in three patients with sciatica and used visualization with epidural contrast injections while the lumbar spine was injected to track. In two patients with multiple disc protrusion, protrusion was lessened by the traction, created by "vertebral distraction." Traction was applied with the patient prone on a conventional "couch," with a thoracic corset and a pelvic harness. They used traction of up to 120 pounds for 38 minutes, with the improvement as noted.

McElhannon, J. E. (1984). *Physio-therapeutic treatment of myofascial disorders.* Anaheim Hills, CA: James E. McElhannon.

McElhannon considers the contraindications to traction to be primary metastatic malignancy, cord compression, infectious disease of the spine, cardiovascular disease, arthritis, old age, pregnancy, active peptic ulcers, hernia, aortic aneurysm, or gross hemorrhoids. But traction is indicated in conditions where you want to achieve "distraction of the vertebral bodies with enlargement of the intervertebral space producing an inward suction effect on the disk; stretching of muscles and ligaments with a tautening of the posterior longitudinal ligament exerting a

centripidal effect on the adjacent annulus fibrosis; separation of the apophysial joints; and enlargement of intervertebral foramina." He recommends mechanical massage of the lumbar spine prior to traction.

He states that the angle of pull in cervical traction will vary from 5 to 50 degrees. In the upper three vertebrae, the angle will be 5–15 degrees. For cervical vertebrae 4 through 7 and dorsal vertebrae 1, 2, and 3, the angle would be 30–50 degrees. "The lower you treat in the cervico-thoracic spine, a greater angle of pull is required, up to 50 degrees, for maximum and consistent results." Proper angle pull for thoraco-lumbar conditions is 15–50 degrees. To affect low thoracic and lumbar vertebrae 1 through 3, the angle of pull must be 15–30 degrees. To affect L3 through L5 and S1, the angle of pull must be 30–50 degrees. "The lower in the spine you treat, the greater angle of pull required."

He believes that mechanical massage should not be done after traction. He also believes that static traction for 20 minutes is preferable to intermittent traction for patients with acute discogenic disease, severe radiculitis, or severe muscle spasms and that a patient with severe muscle spasm should never have intermittent traction. For more chronic problems, intermittent traction (pulling for 30 seconds, followed by release of 10 seconds) is best and gives the greatest results.

In the cervical area, he states that traction of the cervical spine should never start with less than 15 pounds, and never less than 50 pounds in the lumbar, as this poundage is necessary to overcome muscle tension, and less pounds will actually aggravate the patient by introducing reflex spasm. He recommends 3 days of steady traction and then three times a week for 6–8 weeks, with considerable improvement expected after three to five treatments. If the patient does not improve after three treatments, the poundage is increased by 10 pounds. Cervical traction goes up to 60 pounds, and even higher in large male patients, and lumbar traction goes up to 125 pounds. He states that some type of bolster should always be placed under the patient's knees to flatten the lordotic curve while traction is being given.

Nachemson, A. (1966). The load on lumbar discs in different positions of the body. *Clinical Orthopaedics and Related Research, 45,* 107–122.

"The load on the lumbar discs is related both to the body weight of the subject and the position of the body...For a subject weighing 70 kg, the load on the L3 disc in the sitting position is approximately 140 kg. Approximate loads in the other positions are as follows: standing, 100 kg; sitting and forward tilting of 20 degrees, 190 kg; with an additional kg in hands, 270 kg; reclining, lateral decubitus, 70 kg; relaxed supine, anesthetized reclining, 20 kg. If such a subject tilts forward 20 degrees in the standing position and lifts 50 kg by his hands, the total load on the L3 disc will be about 300 kg." In moderate degenerative discs, the pressures are approximately 30% lower than in comparable normal discs.

Nachemson, A. L. (1981). Disc pressure measurements. *Spine, 6,* 93–97.

Intradiscal pressure was measured in over 100 individuals, and it was found that reclining reduces the pressure by 50–80%, but unsupported sitting increases the load by 40%. Forward lifting and weight lifting increased the pressure by more than 100%, and upward flexion and rotation by 400%. "Large augmentations in pressure were also observed in subjects performing various commonly prescribed strengthening exercises."

Nachemson, A., & Elfstrom, G. (1970). Intravital dynamic pressure measurements in lumbar discs. A study of common movements, maneuvers, and exercises. *Scandinavian Journal of Rehabilitation Medicine, Suppl. 1,* 1–49.

This publication refers back to the original material, much of which has already been presented in other papers by Nachemson, but it is a much more comprehensive review.

Neuwirth, E., Hilde, W., & Campbell, R. (1952). Tables for vertebral elongation in the treatment of sciatica. *Archives of Physical Medicine, 33,* 455–460.

The authors state that the intervertebral discs constitute about one-fourth of the entire length of the vertebral column.

They record data referring to vertebral traction as early as the fifth century B.C. in the writings of Hippocrates. He described various procedures to redress kyphosis and in particular recommended the use of a ladder to which the patient was bound, head up or down, and then lifted by a rope which ran over a pulley attached to the roof of a house. Then the ladder with the patient was dropped onto a hard pavement.

They describe a table which can be tilted in either direction, head up or head down, using a handwheel on a worm gear. They mount pulleys at either end of the table to pass straps to the head or the chest or the pelvis.

They always provide preliminary use of heat and sedative massage to the area of the vertebral segment to be elongated and then apply traction, with the intensity gradually increased. At the end of a few minutes, the traction is slowly and gradually reduced to the starting point. Then, after a short pause, traction is reapplied and increased to a higher level, with progressive stages to maximum traction, with 30–60 minutes of rest at the completion of the complete treatment. They gave treatment daily or every other day, and they report that "vertebral elongation" relieves muscle spasm, promotes the return of the protruded disc and the slightly displaced vertebrae to their original lodging, and facilitates reduction of subluxated apophyseal joints, with reduction of pressure upon nerve root blood vessels and lymphatic and consequent relief of pain.

They report that in a cadaver stripped of muscles, 9 kg of traction force was necessary to separate two lumbar vertebrae by 1½ mm. In the living, 100 kg of traction force must be employed to obtain the same results.

They report overall, from their work and that of others, 68% good results in some 400 patients, 69% in another 240 patients, and 58% in another 156 patients. They state that vertebral traction has been found to exert significant beneficial effect in patients with sciatica.

Pal, B., Mangion, P., Hossain, M. A., & Diffey, B. L. (1986). A controlled trial of continuous lumbar traction in the treatment of back pain and sciatica. *British Journal of Rheumatology, 25,* 181–183.

These authors compare a controlled trial of continuous lumbar traction in the hospital in patients with back pain and sciatica with a similar group treated with sham traction. However, they used only a maximum of 8.2 kg, which obviously would be of no value.

Ramos, G., & Martin, W. (1994). Effects of vertebral axial decompression on intradiscal pressure. *Journal of Neurosurgery, 81,* 350–353.

A cannula was connected to the patient's L4-5 space with a pressure transducer. The patient was placed in a prone position on a VAX-D therapeutic table. Changes in intradiscal pressure

were recorded. At a resting state, controlled tension was applied to the pelvic harness. Tension in the upper range was observed to decompress the nucleus pulposus, to below −100 mm Hg. This was only done in three patients.

Snook, S. (1987). The costs of back pain in industry. Occupational back pain, state-of-the-art review. *Spine, 2*(1), 1–5.

In 1987, the average direct healthcare and compensation cost for an individual with back sprain was $5,739. The estimated cost of industrial low back pain in the United States in 1983 was $25.25 billion.

The author quotes an estimate of $14 billion expended on the treatment and compensation of low back pain sufferers in 1976, with an estimate of $25.25 billion in 1983. Lost wages alone were estimated at $11 billion per year in 1975–78. In 1985, it was estimated that 33% of the cost of managing compensable back pain was due to medical care and 67% to "indemnity costs." It appears that we could conservatively estimate that compensable back pain, both in medical costs and lost wages, in 1996 would be around $100 billion. If we include noncompensable back pain, which is at least another similar amount, the total cost of significant back pain in the United States in 1996 would be somewhere between $200–300 billion, counting wages lost or paid out, as well as medical costs, with approximately one-third of that total amount being total medical costs.

An ad from Spinal Designs International (2400 Chicago Avenue, S., Minneapolis, MN 55407) states that the LTX 3000 Lumbar Rehabilitation System (a chair in which the patient sits with a belt around the chest and the bottom of the chair drops out) leads to "lumbar stabilization, intradiscal pressure unloading, free movement and exercise, gentle musculature stretching, and neutral spine positioning."

Wall, P. D. (1996). Editorial comment: Back pain in the workplace. I. *Pain, 65*(1), 5.

Commenting on a task force on "Pain in the Workplace," Dr. Wall states that the "report is an uncritical lurch back 150 years when chronic pain without lesions was already a major problem." He mentions that Charcot considered angina and Parkinsonism to be neuroses because of unknown causative lesion. He further quotes Tate describing back pain without lesion as hysteria, but could be caused by "irritation of the upper dorsal portion of the spinal marrow." Wall goes on to state that the authors of the task force "display no caution in their uncertainty that there is no lesion" and that "there is nothing left to study." He criticizes the task force's consideration of low back pain as "a problem of activity intolerance, not a medical problem." Dr. Wall advises that surgeons should not operate under such circumstances and not prescribe drugs, and he particularly criticizes the fact that the task force recommends abruptly at 6 weeks that "those still complaining of nonspecific low back pain should be labeled activity intolerant and unemployed with a removal of medical and wage benefits." His conclusion is that "'Back Pain in the Workplace' is at best an idiosyncratic, largely untested series of recommendations on how to treat the first six weeks of low back pain, after which advice ends abruptly with the reassignment of the patient to the diagnosis of 'activity intolerance' which is 'not a medical problem.'"

Weisfeldt, S. C. (1971). Ambulatory approach to the treatment of low back pain. *Journal of Occupational Medicine, 13*, 384–387.

Ice packs and traction were used for acute back pain. The use of ice and later moist heat with intermittent traction plus ambulation and exercise afforded excellent relief of pain and earlier return to work, even in industrial accidents. Patients received an average of 8.3 treatments. They actually treated a total of over 500 patients. Of 316 industrial accident patients treated by intermittent traction and ice, 76.6% lost an average of 5.9 days of work.

Unpublished study. An acute low back distress study from the University Hospital, London, Ontario, 1987–88.

This unpublished study reports that 66% of patients had a positive outcome from VAX-D therapy. The criterion for success was a reduction to 50% of the baseline aggregate score for pain and disability.

## APPENDIX B: BACK PAIN PROTOCOL

I. Inclusion criteria
   - A. Pain present for 1 week or more due to ruptured intervertebral disc
   - B. Pain present for 1 month or more for other causes of back pain
   - C. Patient will be available for 4 weeks of continuous therapy
   - D. Patient has adequate financial resources to cover therapy
   - E. Patient is at least 18 years old or has parental consent if at least 15 years old

II. Exclusion criteria
   - A. Pregnancy
   - B. Prior lumbar fusion
   - C. Metastatic cancer
   - D. Severe osteoporosis, with estimates by radiological interpretation of lumbar plain x-rays showing greater than 45% bone loss
   - E. Bilateral spondylolisthesis or spondylolysis
   - F. Compression fracture of lumbar spine below L1
   - G. Aortic aneurysm by physical examination or x-ray
   - H. Pelvic or abdominal cancer
   - I. Rheumatoid spondylitis
   - J. Disc space infections
   - K. Significant cognitive dysfunction
   - L. Psychosis
   - M. Significant opioid, alcohol, or tranquilizer dependency
   - N. Weight greater than 290 pounds (possible exclusion at 250 pounds depending upon weight distribution)
   - O. Significant uncontrolled intercurrent medical disorder
   - P. Hemiplegia or significant paraparesis
   - Q. Severe peripheral neuropathy

III. Negative influences
   - A. Smoking—Patients need to know that results will be 50% less effective
   - B. Consumption of greater than 20 mg/day equivalent of diazepam or four Percodan/Percocet/Tylox

(oxycodone/aspirin or acetaminophen), which will require a detoxification plan
C. Consumption of greater than two cups of coffee, three cups or glasses of tea, or two cans soda pop per day
D. Obesity of greater than 20% above ideal body weight
E. Consumption of prednisone or steroids other than DHEA
F. Overall poor nutrition
G. Serious language barrier preventing effective communication
H. Significant negative attitude on the part of the patient

IV. Evaluation
A. History
1. Comprehensive general medical assessment
2. Spinal-specific questions/issues
a. Details concerning the onset of the pain complaint
b. Factors which decrease or increase pain
c. Location of center of pain, spread, and/or radiation
d. Intensity (average, high, and low, with estimate of percent of time being high or low)
e. Physical limitations due to the pain
f. Mattress (type, quality, and condition)
g. Sensory symptoms (tingling, numbness)
h. Known muscle weakness
i. Bowel, bladder, and sexual dysfunctions
j. Recent or remote spinal injuries
k. Recent or remote spinal surgery
l. Recent or remote diagnostic spinal studies (lumbar puncture, discogram, myelogram, CT, MRI, plain spinal x-rays)
m. Any spinal anesthetic or epidural or steroid injections
n. Trigger point injections or nerve blocks in the past 6 months
o. Acupuncture therapy in the past 6 months
p. Any physical therapy in the past 6 months
q. Any use of a back brace (other than work-required lifting belt) in the past 6 months
r. Family history of significant spinal problems
s. Any personal history of cancer
t. Any personal history of collagen disease (rheumatoid arthritis, systemic lupus erythematosus, scleroderma, mixed collagen vascular disease)
u. Any chiropractor or osteopathic adjustments or manipulation in the past 6 months

B. Physical examination
1. General exam
a. Vital signs (height, weight, blood pressure, pulse, respiration, temperature)
b. HEENT
c. Neck
d. Chest (heart, lungs, and breasts)
e. Abdomen
f. Pelvic (within past 6 months for women)
g. Rectal (essential for all patients)
h. Skin (lesions, thickness/coarseness, redness)
i. Extremities (pedal pulses, cyanosis, clubbing, edema)
j. Neurological
i. Funduscopic
ii. CN II-XII
iii. Muscle strength
iv. Tandem gait with Romberg screen
v. Posture
vi. Sensory—vibration at patella versus malleoli, light touch versus pin-prick for arm compared to leg dermatomes

2. Spinal
a. Lumbar flexion, extension, side bending, and lateral rotation
b. Straight leg raising (lying supine and sitting upright)
c. Hip abduction ("Faber")
d. Palpation of sacrum for sacral shear or torsion
e. Palpation for rotation or focal tenderness of the spine

C. Diagnostic testing
1. Plain x-rays of the lumbar spine, including oblique and flexion/extension laterals done within the past 6 months or after most recent injury or spinal surgery
2. If there is a clinical suggestion of nerve root impairment, then obtain MRI from T12 to L1 to L5-S1
3. CBC and differential, chemistry panel 20, ESR with 200-mm column, urine analysis, TSH, intracellular Mg (Spectral Diagnostics)
4. If MRI is negative for nerve root compression in a patient with severe nerve root signs, then get EMG, NCV to rule in/out a neuropathy

V. Treatment
A. Initial management of all currently consumed analgesic medications and substances (caffeine, alcohol, tobacco, and street drugs)
1. Patient will decrease by 10% per day from initially determined dosage
2. All patients will start Bromase 2 t.i.d. ½ hour a.c.

B. Patients will be taught to use the visual analog

scale for pain measurement at the first appointment with the physician, and then will continue to complete visual analog scales at all subsequent appointments

C. Patients will be issued a TENS unit to be used during all waking hours
   1. Electrode placement will be taught to patient by facility MD or RN

D. Patients will receive a daily pre-DRS vibratory massage or myofascial release using vacuum/inferential current treatment for 30 minutes with heat application to the lower back for 20 sessions

E. Patients will be positioned on the DRS and receive distraction/decompression for 30 minutes using one-half of the body weight plus 10 pounds for 20 sessions

F. After DRS, patients will have a Polar Pack placed on the lower back for 30 minutes

G. After 1 week (five DRS sessions) if patients with clinical and diagnostic imaging findings of ruptured intervertebral disc are not 50% improved, add 1 mg/day intravenous colchicine and 2 g magnesium/B6 intravenous for 5 days, then orally maintain patients on 0.6 mg/day for 6 months

H. After the second week of the program (ten DRS sessions), if improved 50%, instruct the patients in the Shealy exercise program. For those not yet improved 50%, then reassess patients with repeat physical examination

I. For those patients who are *not* 50% better after ten DRS sessions, consider:
   1. Percutaneous electrical nerve stimulation to be done by the facility physician
   2. Referral to anesthesiologist or neurosurgeon for facet nerve blocks
   3. Trigger point injections with Sarapin by facility physician
   4. Enroll patient in laser study protocol and administer laser therapy 2 minutes/day for up to 5 days

J. After 20 DRS sessions or significant improvement of patient's symptoms from multimodality approaches, patient will have an exit physical examination with the facility physician. An after-care plan will be established calling for the use of the Polar Packs, TENS, exercise, relaxation training, use of any substances, pacing techniques, and proper utilization of body mechanics and posture for daily activities

K. Patients return 1 month after treatment for evaluation by the facility physician

## APPENDIX C: REFERENCES REGARDING COLCHICINE


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