New Concepts in Back Pain Management:

Decompression, Reduction and Stabilization

C. Norman Shealy, MD, PhD, FACS and Pierre L. LeRoy, MD, FACS

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, Strafford & 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 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
   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 (Coachis & 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 passé 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 pretreatment 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) summarized 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 have been reported by Ramos and Martine (1994). By cannulizing the nucleus pulposus of L4-5 and monitoring intradiscal pressure via a pressure transducer, three patients were observed to have lowered pressured 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 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:

1. Seperation 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. 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 lordic 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 angels. With the DRS System, the distraction angle is accurately determined via a laser pointer to give precise angulations. 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-minutes 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 the 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 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 the neutral and finally lowering the legs to the floor. Patients start with 1 to 3 repetitions and building up 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 experiences significant improvement or at least a 50% reduction in their pain level after five DRS sessions (1 week), addition of colchicines is helpful; 1mg of intravenous colchicines, with 2 g of magnesium chloride and 100 mg of vitamin B6, is administered daily for 5 days. If a significant improvement occurs during the 5-day colchicines treatment, then the patient continues with the DRS System and continues to take oral colchicines (0.6mg daily) for 6 months, along with magnesium oral spray (allowing at least 200 mg of magnesium for sublingual absorption daily).

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 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 the 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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