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Use of chiropractic manipulation in lumbar rehabilitation

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Abstract—The beneficial effects of manipulation in relieving symptoms and enhancing spinal flexibility can be a valuable tool in the transition of persons with low back pain into lumbar rehabilitation programs. Manipulation may hasten their entry into active care, or permit them to complete programs that might otherwise be interrupted by symptomatic recurrence. Manipulation science and technical procedures are reviewed as a basis to help understand the utility of properly integrated chiropractic manipulation strategies.

Key words: *back pain, chiropractic, manipulation, rehabilitation.*

INTRODUCTION

Rehabilitation of the lumbar spine is a complex process that bridges both physical and emotional factors underlying chronic, recurrent, and postsurgical low back and leg pain complaints. To understand the appropriate context for the use of chiropractic manipulation during rehabilitation, it is useful to examine the aims of the treatment plan as a whole. A brief review of manipulation science and procedures gives a rationale for appropriate integration into a rehabilitation treatment plan.

The successful treatment plan must account for the constellation of factors (**Table 1**) that define the clinical status of the client when rehabilitation therapy begins (1,2). The principal aim of treatment is to address the physical deconditioning that arises from injury and related activity intolerance. Secondarily, rehabilitation offers a means to address residual symptoms fostered by incomplete clinical recovery during the acute care phase of treatment. The specific goals include increased function, reduction of pain levels, and enhanced quality of life; ideally, by promoting a rapid return to a work-ready or preinjury status (3). Desirable clinical benefits include individual self-reliance and decreasing dependence on caregivers. The activity of rehabilitation must strike a balance apropriate to the severity of injury and the fitness of the person, versus the pace and intensity of executing the treatment plan.

Notably, experience and recent research suggest that appropriately used spinal manipulation can be an effective means of aiding persons with low back and leg pain in transition from passive to active care. Manipulation also serves to control symptoms arising from the occasional exacerbations and related musculoskeletal injuries that arise during the course of therapy. The discussion to

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Table 1.
Factors that define a person's clinical status.

Physicial Factors	Psychosocial Factors
Age and gender	Health-related habits
Co-morbid illness	Cultural/family influences
Principal diagnosis	Attitudes/preferences
Condition severity	Emotional/vocational/social function
Clinical stability	Financial status

follow will review the scientific evidence and draw upon practical experience to consider the ways in which chiropractic manipulation can be useful in low back pain (LBP) rehabilitation.

METHODS

Science of Manipulation

Manipulation joins a host of accepted treatment methods within health care for which the mechanisms of action are poorly understood. The analgesic and anti-inflammatory drug acetylsalicylic acid was used for years based upon study of its clinical effects before prostaglandin research offered clues as to its biochemical interactions. The cause of the euphoric effects of the popular antidepressant, amitriptyline, remains obscure (4). Similarly, the means of producing the beneficial effects observed in controlled clinical trials on manipulation of the spine are uncertain.

The favorable clinical outcomes from chiropractic manipulation involving pain relief, increased functioning, and client satisfaction have now been confirmed in a number of studies. Three rigorous literature syntheses have made similar conclusions with respect to acute episodes of LBP (5–7). Seven publications of results with chronic LBP found favorable responses on at least one outcome parameter (8–14). Triano et al. (13) have performed a rigorous randomized clinical trial of persons with chronic LBP. Substantial benefits in pain reduction and functional improvement were observed using a 2-week program of manipulation on a near-daily basis. Meade et al. (11) conducted a long-term pragmatic study contrasting chiropractic manipulation with hospital-based manual physical therapy. Their data suggest that those treated with a limited series of chiropractic manipulation methods received 29 percent greater relief and long-term satisfaction at a 3-year follow-up. A common observation from both of these studies is the persistence of clinical improvement even when a successful treatment regimen has been completed.

While no randomized trials for radicular pain (dermatomal distribution of limb pain consistent with a nerve root) currently exist, favorable observational data have been reported by Cassidy et al. (15). Over 50 percent of persons with symptoms lasting longer than 6 months were improved using a 2-week course of chiropractic manipulation.

Evidence of manipulation effects is seen through enhanced range of motion, specific to the side of the procedure, following treatment (16–18). A number of hypotheses have been expressed to account for this, including release of incarcerated synovial tags (invaginations of the synovial membrane similar to plica of the knee joint) along the spine (19), lengthening of soft tissue (20,21), relaxation of intrinsic spinal muscle hypertonicity (20,21), and disruption of fibrous adhesions secondary to chronic inflammation (19,20,22).

Palliative effects on pain levels have been reported to occur immediately in many chronic clients (13). Speculated neurobiologic mechanisms include reduced stimulation of joint receptors (21) and release of endorphins (23,24). No substantive data are available to support or refute them. Physiologic activity of circulating factors involving substance-P has been recorded; it shows characteristics of threshold effects and specific biological responses from manipulation of the spine. Such changes exceeded placebo effects from cutaneous stimulation, introduction of comparable forces into the gluteal mass, or manipulation of the ankle joint (25–27).

Regardless of the details of the underlying mechanism, the clinical benefits from manipulation, appropriately applied, may be an asset during lumbar rehabilitation. Pain and disability, experienced for extended periods, facilitates chronicity (28–31). Efforts to rehabilitate such persons are complicated by their fear of movement that reinforces deconditioning in a circular pattern. The demonstrated effects of manipulation to relieve symptoms and enhance flexibility can serve as a vehicle to encourage confidence in the safety of movement. This may be valuable both for those being transitioned into rehabilitation programs from passive care, and for those who have experienced an exacerbation or new injury during the course of their rehabilitation. In our experience, manipulation on a limited basis has permitted people to complete programs when symptomatic recurrence would have caused delay in progress, or abandonment of the treatment plan.

Journal of Rehabilitation Research and Development Vol. 34 No. 4 1997

Skill in Manipulation

The selection of manipulative procedures and of those who should receive them requires attention to the details of tissue morphology, underlying pathology or prior surgery, and the functional limitations at both the regional and intersegmental level. Absent pathology contraindicating manipulation, local kinematics and discomfort associated with provocative testing of the symptomatic area should be assessed. Limitations in active, assisted, and resisted range of motion, joint compression, local joint tenderness, and passive flexibility maneuvers (end-feel characteristics, joint play estimates, and over-pressure testing), suggest the site to which treatment is directed. Used collectively, they form a valid basis for discerning healthy from unhealthy clients[1].

Provocative joint preloading is accomplished by positioning the individual for the candidate procedure and using graded, subthreshold forces in the direction of the intended thrust. Those who respond with sharp pain, reproduction of symptoms, or rigid muscular guarding, are poorly matched with the treatment method. These procedures are the biomechanical analogues of orthopedic maneuvers, like the straight leg raise or Nafzigger's test, designed to elicit involvement of the neural elements.

As the local and regional mechanical idiosyncrasies are appreciated, procedures can be modified to account for anatomical and pathologic peculiarities and the severity of symptoms affecting client tolerance. Treatment modification is exercised through manipulation control strategies, tempered by the training and experience of the provider.

Control strategies consist of systematic effort to manage each element contributing to the effective loading of the spinal motion segment. In practical terms, the factors that can be directly and indirectly controlled are listed in **Table 2** (32–43).

The determinants of successful administration of manipulation are local changes in pain, muscle tension, and flexibility. As these intermediate outcomes accrue over the course of therapy, the clinical effectiveness of treatment can be defined. Increased flexibility with reduced symptoms facilitates the rehabilitation process.

There continues to be some controversy over the terminology used to describe manipulation procedures. For the purposes of this discussion, the evidence-based definition adopted by the Agency for Health Care Policy and Research (AHCPR) will be used (3). Their considerations

Table 2.
Control parameters for spinal manipulation.

Client posture
Static
Dynamic
Preload amplitude
Load direction
Load peak amplitude
Load impulse rate
Load duration

focused on thrusting procedures commonly characterized by high velocity, low amplitude (HVLA) applications of load by the manipulator. These represent the most common class of chiropractic manipulation procedures, as can be ascertained by their broad distribution in training curricula in contrast to other forms. Beyond definition, the 1994 AHCPR report has limited value in the discussion of manipulation in rehabilitation as a result of its self-imposed constraint limiting the conclusions of the panels to acute, adult LBP episodes. Spinal manipulation includes many different techniques and may involve preliminary preparation of the joint and its surrounding tissues, using stretching, assisted motion, and other methods. Loads, both forces and moments, are applied to the joint, and it is moved to its end range of voluntary motion. An impulse load is then applied. **Figure 1** shows the biomechanical factors leading to the resultant load that passes through the spine at the level of interest (39). The effective load is the summation of forces applied by the operator, with the inertial forces generated by the motion of body segments, and the internally generated tensions from client muscle reactions (38,44).

In general, loading of the spine of the client by the operator can be administered from an initial static posture, or during motion of the client through a preset range. Positions are chosen to facilitate the manipulation procedure by minimizing the coupling of segment components, by opening the joint to its unpacked state (22,45,46), and by modifying the relative amplitude of the load components to the targeted section. The effect of posture on the transmitted load components (**Figure 2**) has been determined experimentally (41). Selection of initial static or dynamic conditions provides control over the inertial loading effects that are contributed by the major body segments (pelvis and lower body vs. trunk and upper body). Preloading of the spine in combination with the initial posture and load direction narrows the region through which the peak loads are transmitted. Variation

[1]Triano JJ, McGregor M, Doyne M, et al. Validation of manual diagnostic procedures. Spine (in revision).

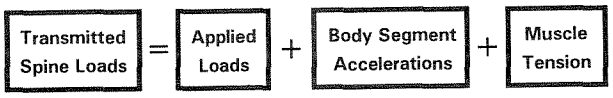

Figure 1.
The resultant load passing through the spine is an algebraic sum of the applied manipulation loads, inertial loads from movements of the body segments above and below the target level, and the internal muscle tension.

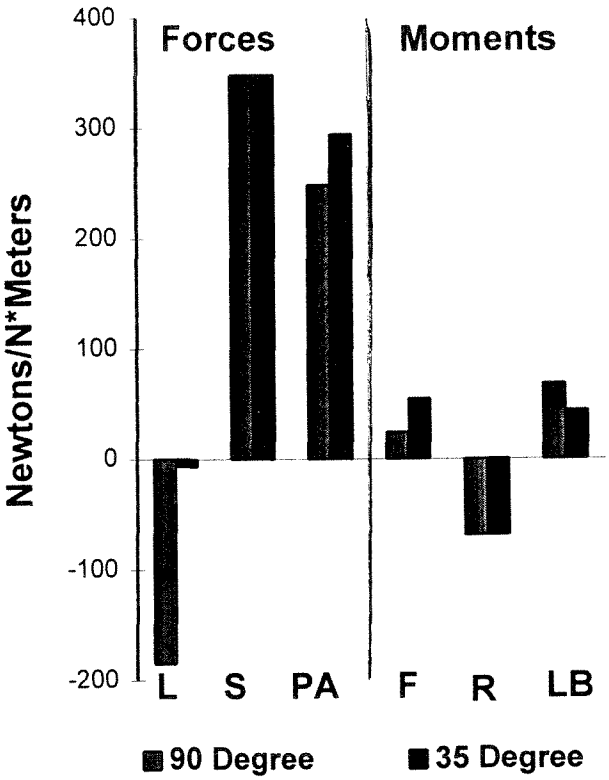

Figure 2.
Effects of changing pelvic position during a lateral recumbent lumbar manipulation (**Figure 9**) on the typical forces (left) and moments (right) that are transmitted. Ninety degrees pelvic orientation perpendicular to the support surface; 35°: pelvic orientation rotated 35° from the support surface; L: forces directed left-to-right; S: forces directed toward the head; PA: forces directed from posterior to anterior; F: flexion, R: Rotation, LB: Lateral Bending moments.

of the rate of impulse loading influences the local deformation or displacement of body segments. Finally, the duration of preload and peak load time, coupled with verbal instruction, are used to influence the state of relaxation of the musculature. Undesirable muscle action can generate internal tension loads and moments that may confound the treatment effort.

A wide variety of procedures is available and the operator must be facile with a number of options for each clinical circumstance, particularly when comorbidity of function and structure exists. The skill of the operator is believed to be a function both of training and experience. Recent evidence suggests that proficiency is not transferable between procedures even for the same region, but requires persistent practice for adequate administration (39). The skill levels of providers can be assessed both by biomechanical and skill-rating systems (43,47). **Figure 3**

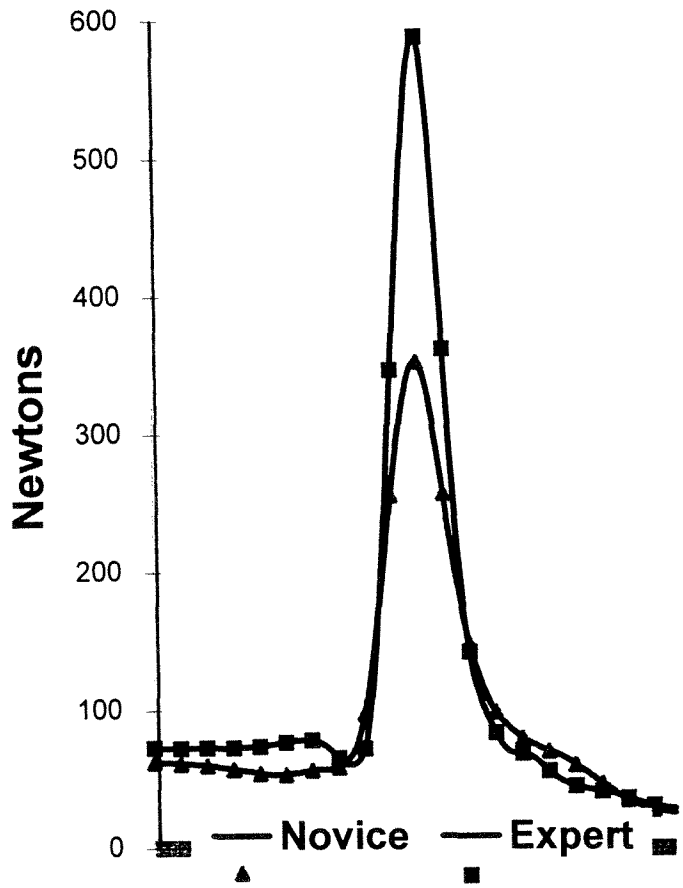

Figure 3.
Measured differences in magnitudes for typical manipulations performed by a peer-rated expert versus a novice using the same HVLA procedure. Forces transmitted through the spine of the client under controlled conditions were recorded by a specially constructed table, instrumented to provide high fidelity in recording applied loads. Amplitude, duration, and slope show the principal comparisons.

demonstrates the types of technical differences observed between expert and novice practitioners (43).

The level of skill is not inconsequential. While the reported incidence of complications from manipulation of the lumbar spine is quite small (48), the loads that can be transmitted are significant. In biomechanical terms, computer modeling of the effects of transmitted loads can be estimated (49). An equivalent task is comparable to a 5 ft 7 in male, weighing 170 lb, holding a 20 lb weight at waist level, and assuming an asymmetrical posture of 20° rotation with 20° of forward flexion.

Types of Procedures

Techniques of manipulation may be categorized in a number of different ways and often are grouped by terms that are arbitrary, reflecting the preference of the primary developer. While many hypothetical biological effects have been discussed in the literature, the evidence is restricted mainly to questions of clinical effectiveness and biomechanical loading effects, limiting this discussion to that of applications. For these purposes, categories (**Table 3**) will be logically consistent with the parameters of the control strategies as have been described.

Obviously, the spine bears forces and moments under all circumstances. Nachemson (50) was one of the first to show that the size of the loading effects is highly variable and dependent upon the person's posture and external applications. A reference posture, for example, upright standing in the anatomical position, may be used as a basis for classifying procedures based on biomechanical effects. Unloading of the spine may be defined when the effects of upright posture and external loads are reduced. For instance, unloading occurs when people participate in aquatic therapy, or when spinal motion is induced in recumbency by movement of the support surface.

In keeping with the clinical objectives to reduce symptoms and enhance function of the spine, the rate and amplitude of spinal loads that can be induced extend over a broad continuum. Low amplitude loads and slow speed motions, sometimes referred to by the separate descriptors of manual mobilization or continuous passive motion, are often selected as maneuvers preparatory to more aggressive procedures under unloaded or loaded conditions. When warranted by condition severity or client intolerance, they may constitute the total intervention of a given treatment session.

The unloaded spine is moved through a radius of symptom tolerance to encourage joint flexibility and reduce muscle tension (**Figures 4** and **5**). Action is focused at the level of interest principally through client positioning (**Figures 6** and **7**); HVLA chiropractic methods then may be introduced. Procedure selection is made based on the existing regional and intersegmental motion restrictions, client tolerance during provocation testing, and provider preference and skill. The fundamental purpose is to restore normal function of the motion segment, reducing stressful biomechanical loads and related symptoms and allowing the affected tissues to begin a healing process.

Motion-assisted methods offer additional inertial loading of the spine by controlled movement of the lower

Table 3.
Examples of procedure types.

Unloaded spinal motion
Continuous passive motion
Prone recumbent flexion/extension
Lateral recumbent side-bending
Manual flexion/distraction
Prone recumbent flexion
Prone recumbent flexion with side-bending
Manipulative procedures
Static high velocity, low amplitude thrusting (HVLA)
Prone recumbent thrusting
Prone recumbent cam-driven drop mechanisms
Lateral recumbent, coupled postures
Upright seated rotational maneuvers
Dynamic motion assisted HVLA
Prone recumbent thrusting
Prone recumbent cam-driven drop mechanisms
Lateral recumbent, coupled postures

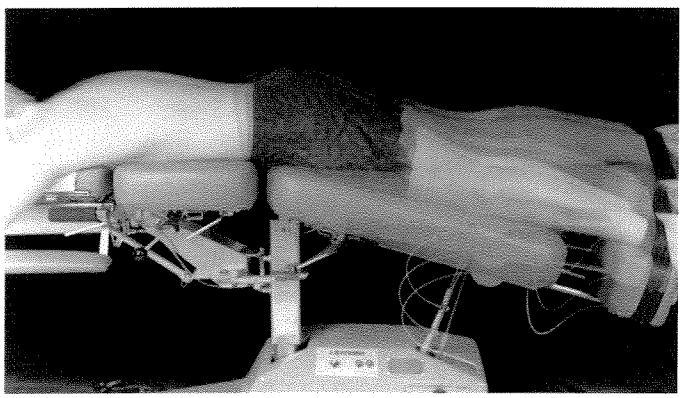

Figure 4.
Prone recumbent, unloaded spinal flexion induced by a continuous passive motion controlled for speed, range, and axis of spinal rotation. The abdominal support may be released to accomodate lumbar lordosis as may be desired.

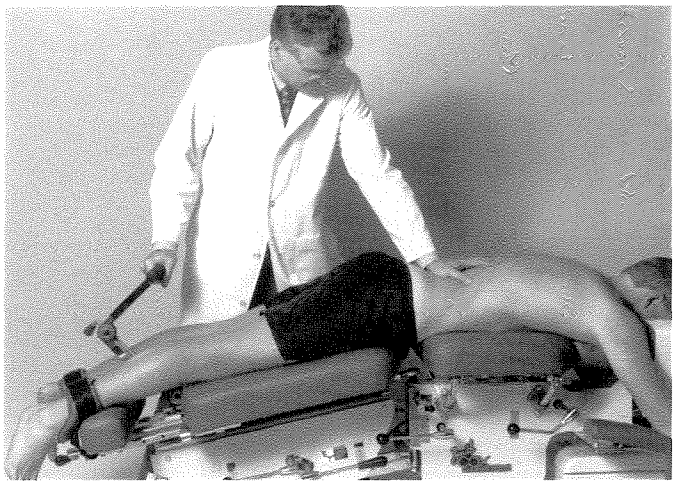

Figure 5.
Manual flexion-distraction procedure loading the spine with auxiliary pressure. Motions may be unloaded and in multiple directions including circumduction.

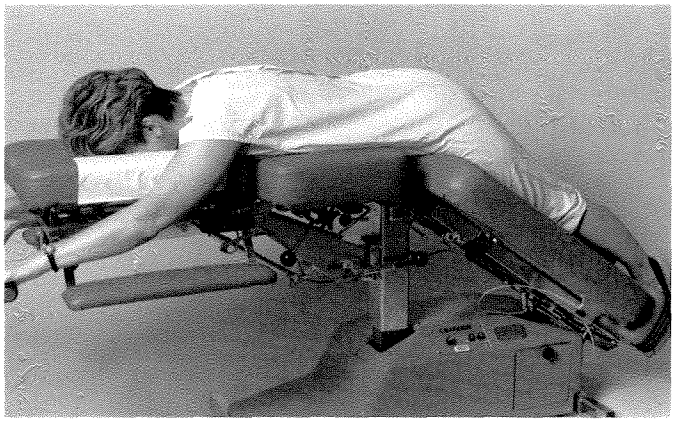

Figure 7.
Continuous passive motion focusing on lumbopelvic flexion. Lateral bending may be induced separately, or in combination with the motion shown.

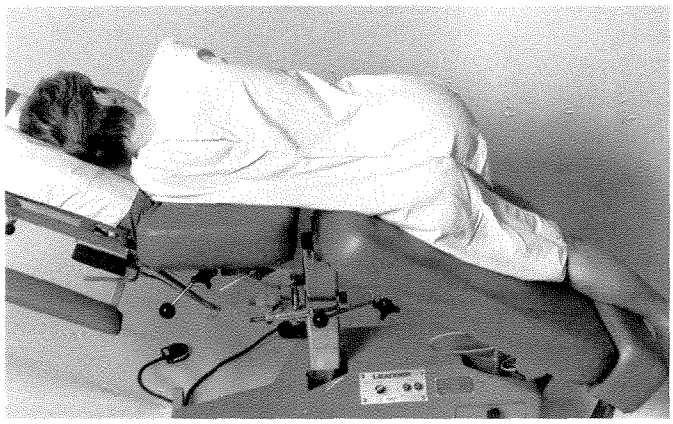

Figure 6.
Continuous passive motion in left lateral recumbency with left lateral bending. Flexion or extension of the spine may be induced separately or in combination with the position shown.

Figure 8.
Cam-driven drop procedure applied to the lumbopelvic junction from a static initial position. A preset threshold of force trips a 0.63 to 1.59 cm drop of the pelvic support surface, as controlled by the predetermined settings of the cam mechanism.

body. They enhance the applied HVLA components. If linked with motions consonant with the direction of the procedure, the transmitted loads are increased. This may help offset the difficulties caused by the mass of larger individuals when static initial positions are used. Conversely, timing of the HVLA in opposition to the motion, may subtract from the applied loads. Prone recumbent thrusting positions rely upon initial client posture to optimize the desired joint movement. Cam-driven drop mechanisms (**Figure 8**) allow the operator to reach a threshold of applied load on one side of the joint before the support falls a constant amount (0.63–1.59 cm). Mechanically, at the joint level, this results in a sequence of static shearing preload, release, and high-rate impulse loading arising from the fall of the body mass of the client and the net thrust effort of the operator. Lateral recumbent procedures, perhaps, are the most complex (**Figure 9**). They permit the coupling of motions in all three planes for both static and dynamic applications. Upright

Journal of Rehabilitation Research and Development Vol. 34 No. 4 1997

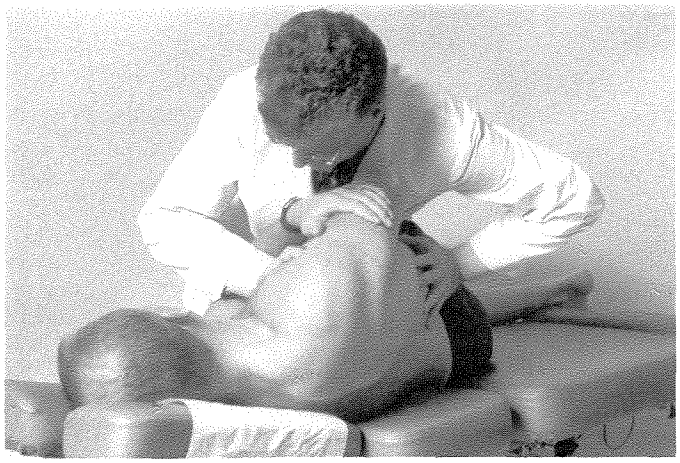

Figure 9.
A lateral recumbent lumbar manipulation can be applied with or without rotation and left or right lateral bending initial postures. The manipulation may be administered from a static starting position or in phase with a controlled passive motion induced by the table.

seated procedures (**Figure 10**) are limited in application to circumstances where flexion of the lumbar spine as an initial posture is desirable. Coupling of three-dimensional motions is again permitted. These procedures also take advantage of the inertial loads induced from the motion of the upper body during the administration of the procedure itself.

Transition from Passive Care

In terms of client experience with manipulation treatment, there are two entry paths to rehabilitation: chronic complaints with treatment plans that include a manipulation component and those that do not. By definition, manipulation is a form of passive care where the responsibility for recovery is vested in the care giver. Anyone presenting with risk factors of chronicity (**Table 4**) should be moved promptly to an active care program of rehabilitation. For cases that have not adequately resolved their complaints when manipulation has been the primary treatment approach, a rapid transition should occur. Beginning with functional assessment and setting of treatment goals consistent with the lifestyle and work tasks of the client, the onset of rehabilitation usually is associated with a quick decline in the frequency of manipulation. An overlap interval of up to 2 weeks may be useful for those with psychosocial overlay, to help encourage their acceptance and confidence in the new treatment strategy.

Figure 10.
Seated lumbar procedure may invoke rotation, flexion, extension, or lateral bending under pre-load by the body weight of the individual.

If manipulation has not been performed, and appropriate clinical findings are present, a short term of care should be offered (21,46). Clinical benefits should become apparent within 2 weeks at a rate of 2 to 5 sessions per week (19,51,52). It is common practice to incorporate recommendations for the client to perform simple flexibility and isometric exercises at home as a means to maintain the gains made through the manipulation. If nonresponsive to manipulation, the person should be assessed functionally and moved directly into an active rehabilitation program (53). On the other hand, favorable results lead to continued care at a rate of from 1 to 3 sessions per week (51) until maximum therapeutic benefit is

Table 4.
Risk factors for chronicity.

Somatic pain, non-responsive for 2-3 weeks
Anxiety or apprehension
Family disruption
Job dissatisfaction
Heavy therapeutic or recreational drug use
Persistent limitations in activity

achieved, generally within 3 months. After the initial trial therapy period of from 2 to 6 weeks, rehabilitation may be added to the treatment plan as needed.

The last alternative use of manipulation in rehabilitation serves to control symptoms that occasionally arise from aggravation or new injury associated with the increased stress and exertions of the program. These complaints should be assessed as a new presenting complaint with appropriate diagnostic intervention as needed. Treatment follows the course of an acute disorder with special attention to the psychosocial and motivational factors. Passive care, then, focuses on the minimum necessary to empower the client to remain in the rehabilitation program.

Discopathy and Radiculopathy

Persons with central axis pain and with peripheral manifestations in the buttocks or leg may have disease affecting the intervertebral disc. Likely, this is the most controversial group of clients to be treated with manipulation (3,15). Cases exhibiting progressive neurologic findings or evidence of cauda equina syndrome should not be submitted to treatment with manipulation methods. The remainder, however, may well benefit (54,55). Triano et al. have recently shown immediate reduction in severity for both back and leg pain complaints in a small group of persons with chronic pain with positive provocative discography (55).

Suspected disc disease may be prepared for manipulation through the use of continuous passive motion (**Figure 4**) or manual flexion-distraction (**Figure 5**). Motion bias, the posture or direction of motion that relieves symptoms, can be determined through use of provocative maneuvers. They are informative for client positioning, the direction of movement used in preparation, and for modifying the manipulation to accommodate the idiosyncrasies of the disc lesion. Posteriorly directed discs that do not affect neural components may respond to either unloaded flexion or extension maneuvers, as may be assisted by unlocking the abdominal support to affect lordosis. The individual motion bias must be assessed. If there is direct mechanical irritation of the neural elements, flexion usually is not beneficial. As symptoms are relieved, HVLA procedures may be administered. The principal effort is to encourage motion that opens the canal or lateral recess and reduces facetal pressure. Load direction, amplitude, and timing are varied according to the desired biomechanical effects and individual tolerance to provocative testing. Generally, these types of cases are more complex and require more intensive therapy, with treatment as often as five times per week.

Facet Disorders

Two types of facet disorders can be described in the lower back. The first is a simple posterior joint (facet) syndrome characterized by pain on extension and with joint compression (15,56,57). The second is the posterior joint syndrome complicated by lumbar instability (15).

The simple facet syndrome is believed to arise from mechanical derangement or instability (15), where inappropriate loading of these joints may occur during normal activities of daily living. Pain may be located centrally over the spine with scleratogeneous radiation into the buttock and lower limb. Pain is present on palpation over the articulations, with decreased range of motion and increased pain with low back extension and joint compression. Simple tasks like rolling over in bed may waken the person with pain. Manipulation for simple facet syndrome is designed to open the facet joints, restore motion, relax associated hypertonicity of the muscles, and allow joint irritation to subside.

Facet syndromes may be a complication of unstable segments (15). Treatment is not directed to the hypermobile motion segment, but rather to adjacent areas that show clinical signs of limited intersegmental flexibility (15). Modified procedures are selectively applied to the joints that are painful. Relief of the mechanical stress on the facet is signaled by symptomatic reduction. Regional stabilization exercises may be used as a part of the rehabilitation treatment plan to form a muscular corset that will encourage stable motion. The prognosis in these cases is less favorable than in the simple facet syndrome (15) as may be expected from the nature of the comorbid conditions. Manipulation should be used sparingly and selectively in the management of these cases.

Sacroiliac Syndrome

Biomechanically, the sacroiliac (SI) joint is complex and incompletely understood. Historical controversy over

this joint as a pain generator has been soothed through recent studies using diagnostic and therapeutic injections (58–62). The diarthroidal function of the joint takes place at the level of the second and third sacral segment (63). It is an atypical synovial joint with a well innervated joint capsule (64). The motion of the adult joint shows complex tri-axial component interaction between the right and left sides (65). During gait, the sacroiliac motion exhibits a unilateral anterior joint opening and contralateral closing. Clinically, the open joint is most often found on the side of the leg that is striding forward. Biomechanical studies have shown that the side of the pelvis that opens during a step, however, may be idiosyncratic (65). For the purpose of clinical analysis, three axes of rotation often are described: 1) transverse, passing from left to right through the center of the joint, 2) diagonal descending, passing from upper left to lower right, and 3) diagonal ascending, passing from lower left to upper right. Abnormal motion may be found around one or more of these axes. Their determination helps in the selection of the most appropriate manipulation to administer. Lateral recumbent and prone drop HVLA procedures (**Table 3**) may be augmented by continuous passive motion in obtaining the desired normalization of motion.

The epidemiology of SI lesions is poorly described. The joint is weakest in vertical and torsional loads (63). Pathogenesis is associated with complex and asymmetrical motions under external loads and has high incidence after surgical fusion in the low back. One speculative hypothesis assumes that there is a transfer of additional stress to the SI when the motion segments above are fused, as is suspected to occur for discs above the level of fusion.

The symptoms of a SI lesion must be differentiated from those associated with primary disc and posterior element disease. The classic finding is localization explicitly to the posterior superior iliac spine (PSIS). Pain may also refer centrally over the lumbosacral junction and sacral body, buttock, posterior thigh, groin, and even into the lower leg (58,59). Characteristically, limitation of function is observed during flexion and standing with unilateral lifting of the knee (Stork test). Pain usually is exacerbated by prolonged walking or sitting, flexion, extension, and FABRE (**Figure 4**) test. Tenderness often can be found over the PSIS, ASIS, and at the superior symphysis pubis. Following aggravation by sitting, walking for a short interval and recumbent resting often relieves acute symptoms.

Manipulation in Postsurgical Rehabilitation

Several factors must be weighed in planning treatment for persons with postoperative complications who can benefit from manipulation. They include the type of procedure, presence and type of instrumentation, stage of wound healing, iatrogenic morphological changes, and diagnosis. Recent operation may contraindicate any manipulative procedures. Simple laminectomy is the least invasive. Persistent pain or complications may be treated as soon as the wound is closed and any stitches removed. Following laminectomy with discectomy, an interval of from 3 to 5 weeks is recommended to allow scarring over of the outer annular fibers of the disc. Fusion procedures, either with or without hardware instrumentation, must show solid fusion on flexion/extension radiographs. This generally requires an interval of from 3 to 5 months.

There are few studies on the incidence of postsurgical complications for which manipulation has been useful (64,66). SI syndrome has been observed in up to 23 percent of cases with persistent lumbopelvic and leg pain complaints (64). In prospective observational study, over 90 percent achieved significant relief of symptoms through HVLA maneuvers. Once the joint shows evidence of restored movement that persists, treatment is discontinued. Experience with these people shows them prone to recurrent episodes that are quickly resolved to pre-episode status with implementation of manipulation procedures. For those who have undergone multiple level fusions or multiple operative procedures, empirical evidence predicts a more frequent incidence of exacerbation of new episodes, probably owing to the increased load sharing required of the SI joint.

CONCLUSION

The rationale for using chiropractic manipulation as a component of the rehabilitation treatment plan for appropriate cases is strongly supported when the therapeutic goals are compared with the evidence of clinical benefits. Chronic and postsurgical low back and leg complaints involve complex interactions of physical, emotional, and environmental factors (**Table 1**). The clinician has control over very few. The client can be best served when the treatment plan accounts for as many of the factors that are contributing to chronicity as is possible.

Persons with chronic pain adopt learned behavior to avoid activity that either has been symptom-evoking in

the past, or that they fear will induce pain. Avoidance behavior contributes to further levels of deconditioning in a downward clinical spiral of chronicity. Manipulation of the spine offers a vehicle to address two of the physical objectives: increasing function and decreasing symptom levels. Skilled chiropractic manipulation permits adaptations of procedures to the unique considerations of each case. Multiple preliminary options are available to prepare the person for manipulation. Using various control strategies, each manipulation procedure may be modified to accommodate the anatomical and pathological features. In the experience of the authors, judicious integration of manipulation into the rehabilitation treatment plan helps span the fear of movement and helps sustain the momentum of improvement when any symptomatic exacerbations occur. These are tangible benefits to the quality of caring in health care delivery.

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