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SYNDROMES OF THE LUMBAR SPINE, PELVIS, AND SACRUM

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Lower back pain and lower extremity pain are two of the most common presentations to the primary care physician. Low back pain is the second or third most common entry complaint to the health care system. Sixty percent to 80% of the adult population will have at least one disabling episode of low back pain during their lifetime. Syndromes of the lower back and lower extremities are expensive to the insurance industry, public and private. The low back comprises approximately 25% of industrial injuries but consumes 90% of worker's compensation costs.[1-4] The diagnosis and appropriate treatment of low back pain syndromes are challenges to the physician in primary care and specialty practice.[1]

There are many structures within the lumbar spine, sacrum, and innominate bones and their associated capsules, ligaments, and other myofascial elements that can be generators of pain. Nociceptive nerve endings are ubiquitous throughout the tissues of the region, and it is a challenge to identify the structure that is the generator of pain in low back syndromes. Altered functional capacity of numerous structures within the region can result in nociception and pain perception. Farfan[2] described the cause of low back pain as mechanical. Biomechanic fault can result from dysfunctional as well as pathologic changes within the anatomy. The medical care system continues to be fascinated with and give primacy to disease of the intervertebral disc. Since the classic work of Mixter and Barr,[12] much attention has been given to studying the pathology, biochemistry, diagnosis, and treatment of the intervertebral disc. There are multiple treatment algorithms based on the disc as the primary cause of low back pain. Multiple therapeutic interventions have evolved for the treatment of lumbar disc disease, including a variety of surgical interventions. Despite scientific progress in this area, 60% to 70% of back pain continues to be identified as idiopathic.

Another conundrum facing the spine care practitioner when dealing with

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back pain is that 35% to 45% of the asymptomatic population will have positive images, CT or magnetic resonance, for intervertebral disc disease, including major herniation.[11, 13, 16] If herniation of the intervertebral disc causes back pain, why are these patients asymptomatic? There must be factors beyond the structural pathologic condition shown by imaging procedures.

DIAGNOSIS OF THE LOW BACK PAIN SYNDROME

As in all medical practice, the foundation for the diagnostic process is adequate history and physical examination. The more comprehensive the history and physical examination are and the more experienced the clinician is, the better the diagnostic outcome will be.[5] Ninety percent of a physician's diagnosis is made by history and physical examination. In the low back pain syndrome clinicians make use of imaging procedures, electrodiagnosis, laboratory findings, and computerized motion and strength assessment equipment. These highly technical procedures should be used to verify the impressions gained by the history and physical examination.

STRUCTURAL DIAGNOSIS

In addition to standard orthopedic and neurologic tests used in the differential diagnosis of low back pain syndromes (mainly reflex testing, sensory assessment, motor weakness, and neural and dural tension signs), a structural diagnostic examination of the musculoskeletal system can be helpful in determining the presence of altered function of the related elements of the musculoskeletal system and their potential clinical significance. The structural diagnostic process is a three-staged procedure searching for the diagnostic entity *somatic dysfunction*. Somatic dysfunction is defined as impaired function of related components of the somatic (body framework) system: skeletal, arthrodial, and myofascial structures and related vascular, lymphatic, and neural elements.[10] Somatic dysfunction can be associated with structural pathologic conditions of the lumbar spine and pelvic regions such as lumbar spondylosis and spondylarthrosis, spondylolisthesis, and degenerative disc disease, including bulges, herniations, extrusions, and sequestered elements. Significant symptom generating somatic dysfunction can occur in the absence of any of the aforementioned conditions. In most instances there are combinations of structural and functional alterations in the patient's presentation. The clinician's challenge is to identify which element is the major producer of pain and whether it is single or in combination with others. A well-performed structural examination of the musculoskeletal system can be of assistance to the clinician in the differential diagnostic process.

Structural diagnosis begins with the screening examination[8] of the total musculoskeletal system, assessing symmetry of form and function and attempting to answer the question, "Is there a significant dysfunctional component in the musculoskeletal system?" If the answer is yes, the second question is "Where is the region of greatest significance?"

The scanning examination leads to an in-depth analysis of the functional capabilities of the region. Based on the findings of the scanning examination, a specific segmental definition is made of the dysfunctional segment(s), their particular characteristics of altered motion, and specific abnormalities in tissue texture. Based on this structural diagnostic process, the clinician is better able to

decide which of the many different interventions of manual medicine might be most appropriate to restore maximal functional capacity to the area.

Although most patients present with lower back pain that is mechanical, the clinician must be aware of the possibility of back pain associated with disease in one of the internal viscera. Malignancy and inflammatory or infectious conditions should be ruled out by an adequate history, physical examination, and appropriate imaging and laboratory studies. Back pain in an individual younger than 18 years of age and older than 50 should alert the clinician to the possibility of nonmechanical back pain.

THERAPEUTIC DILEMMAS

Many patients experience acute mechanical back pain that is self-limiting with a brief period of rest, appropriate use of ice, and simple analgesics. Because most patients are symptom-free irrespective of the treatment intervention in 2 to 3 weeks, any other intervention must hasten the rate of recovery, earlier return to activities of daily living, and earlier relief of pain. Appropriate manipulation has been shown to assist many patients in this respect.[15]

A second therapeutic dilemma is the high recurrence of back pain. Although the patient may become asymptomatic in 2 to 3 weeks without extensive treatment, the clinician should pursue factors in the patient's occupation or lifestyle that might predict susceptibility to recurrence. Prevention becomes the hallmark of patient management. Issues such as poor body posture, poor ergonomics at the worksite, deconditioning, obesity, and tobacco, alcohol, and drug abuse should be evaluated and dealt with as appropriate.

Recurrent back pain is a major problem alone, but it may lead to chronicity as well. The time when a patient moves from an acute, or acute recurrent pain, to a chronic back pain has some variation. Any patient continuing with disabling back pain beyond 3 months should be viewed as having entered the chronic phase. A distinct difference clearly exists between acute nociceptive pain and chronic pain. Acute pain is sharp, lancinating, localized, and associated with ongoing tissue damage, and it responds well to appropriate analgesics and narcotics. Chronic pain is more diffuse, poorly localized, and not associated with ongoing tissue damage, and it responds poorly to analgesics and narcotics. Recent research has shown the difference in the neural anatomy, neural pathology, and neural pharmacology of chronic central pain.

A third therapeutic dilemma is the need to deal with the myriad psychosocial issues associated with disabling back pain in society.

The patient who is a major challenge to the clinician, a frustration to industry and insurance companies, a burden to the family, and an unhappy, depressed individual is the patient suffering from chronic low back pain. These patients bounce around in the health care delivery system from doctor to doctor and have numerous diagnostic tests and a variety of therapeutic interventions. In this author's opinion a patient with disabling back pain lasting longer than 3 months deserves one comprehensive, interdisciplinary evaluation leading to a comprehensive treatment plan that prevents dependency and provides the patient with an understanding of his or her situation and the means to control the pain in the future.

As a practitioner of manual medicine who is involved in an interdisciplinary rehabilitative team dealing with patients with chronic failed low back pain, a cluster of biomechanic dysfunctional entities has been identified and termed the *dirty half dozen*.

THE DIRTY HALF DOZEN

A study[6] made of 183 consecutive patients presenting with disabling back pain with an average of 30.7 months found a high incidence of the following six structural diagnostic findings. More than 40% of the patients presented with low back pain alone, and the remainder with radiation of pain to the thigh and some to the lower extremity. No patient presented with a complaint of leg pain alone. Eighteen percent of this population had failed previous surgical intervention. The remaining 82% had failed a variety of nonoperative care interventions. Traditional neurologic and orthopedic testing was not helpful in identifying the cause of the patient's difficulty. Reflex changes were present in only 10% of the population, motor weakness in less than 10%, and sensory loss in 7%. Straight leg raising was more positive for pain caused by hamstring shortness and tightness, the initiation of pain over the sacroiliac joint, and pain in the lumbosacral region than in the generation of frank radicular pain. Only 3% of these patients had frank radicular nerve pain, and none had a crossed straight leg raising sign, as is common in discogenic radiculopathy.

The incidence of the dirty half dozen was many times greater than positive orthopedic and neurologic tests. Because of this, it is advocated strongly that a structural diagnostic process be performed as part of a comprehensive patient evaluation to elicit elements of the dirty half dozen, which include (1) pelvic tilt and short leg syndrome, (2) non-neutral lumbar mechanics, (3) pubic dysfunction, (4) innominate shear dysfunction, (5) restricted sacral nutation, and (6) muscular imbalance.

Short Leg and Pelvic Tilt Syndrome

The clinical significance of anatomic shortening of a lower extremity and resulting unleveling of the sacral base plane remains controversial.[4] Differing opinions exist about the significance of leg shortening and sacral base declination. Some research evidence suggests a relation between leg length inequality and back pain.[3] Many studies of patients with symptomatic back pain have shown an incidence of 55% to 70%. This compares with the 8% to 20% found in asymptomatic populations. This author[7] empirically has found the use of lift therapy in the presence of sacral base declination of 6 mm to be effective in the management of patients with chronic and recurrent low back pain.

The current study found that 63% of the population had unleveling of the iliac crest and greater trochanter by more than 6 mm. An index of suspicion of significant pelvic tilt and short leg syndrome occurs when the clinician kneels or sits behind the patient, who is standing erect with his or her feet placed acetabular distance apart, and palpates each iliac crest (Fig. 1). The finding should be evaluated further by appropriate imaging studies, particularly antero-posterior and lateral plane films of the lumbar spine and pelvis made for postural study.[17] This finding is treated easily by the appropriate use of heel and sole lifts in the shoe to level the sacral base plane and equal the length of the leg. Balancing the sacral base plane and equalizing leg length enhance the potential for symmetric function of the lower extremities, pelvic girdle (including sacroiliac joints) and coupled side bending and rotating of the lumbar spine during gait.

Figure 1. Palpation of the iliac crest for pelvic unleveling.

Non-neutral Lumbar Mechanics

When the trunk is upright and the lumbar spine has normal function, coupling of side bending and rotating is to opposite sides. If something interferes with normal intersegmental lumbar vertebral motion, the lumbar spine loses the capacity for symmetric neutral coupling and results in one or more vertebral segments coupling with side bending and rotating to the same side. This non-neutral coupling occurs physiologically only when the trunk is bent forward and side bending or rotating to one side is introduced. Body posture determines when the lumbar spine is at the greatest risk for torsional injury to the disc, altered muscular balance, and zygapophyseal joint restriction resulting in the facet syndrome. A suspicion that non-neutral lumbar mechanical behavior is present occurs when the clinician asks the patient to side bend right and left from neutral in the standing posture (Fig. 2). If the induced curve fails to show a smooth c-shaped convexity and fullness of the paravertebral musculature on the side of convexity, there is presumptive evidence of non-neutral lumbar vertebral mechanics. Non-neutral mechanical behavior is manifest by straightening of the induced convexity and fullness on the side of the concavity.

Definitive diagnostic testing confirms non-neutral mechanical behavior of the lumbar spine by assessing the lumbar transverse processes in the prone neutral position and in the prone prop position, inducing lumbar extension (Fig. 3). Most non-neutral dysfunctions of the lumbar spine are those associated with restricted extension. To test for flexion restriction, the operator can evaluate the posterior aspect of the transverse process in the fully flexed position and compare that with the prone neutral position. Non-neutral mechanical behavior of L3, L4, and L5 occurred 85% of the time, with a more than two-to-one ratio of extension versus flexion restriction. Manual medicine treatment to restore neutral coupling of the lumbar vertebrae not only assists in the management of pain but also provides for more normal lumbar mechanical behavior during the walking cycle.

Pubic Dysfunction

Restricted mobility of the symphysis pubis and asymmetry of relationship right to left against the horizontal plane are common findings in this population.

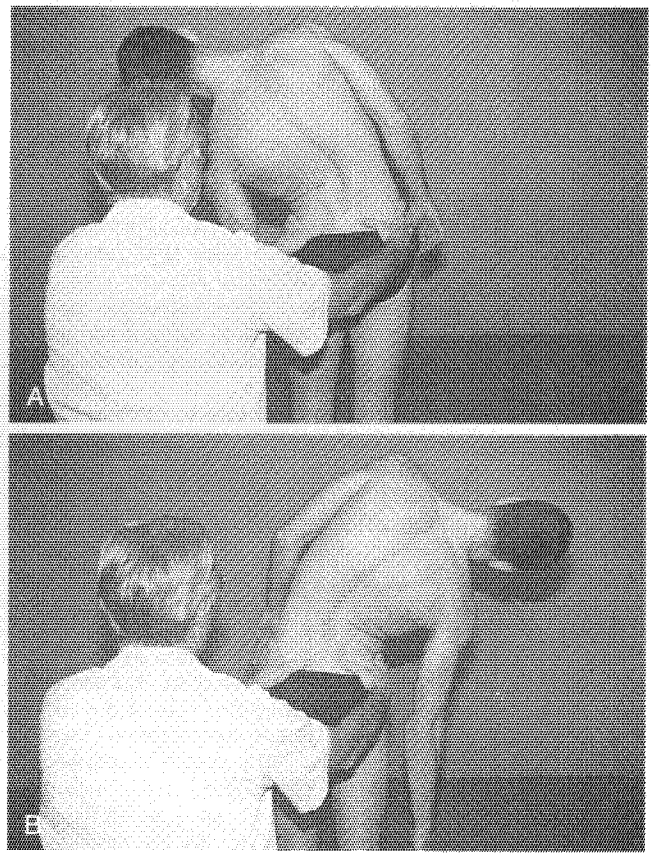

Figure 2. *A*, Trunk side bending, left. *B*, Trunk side bending, right.

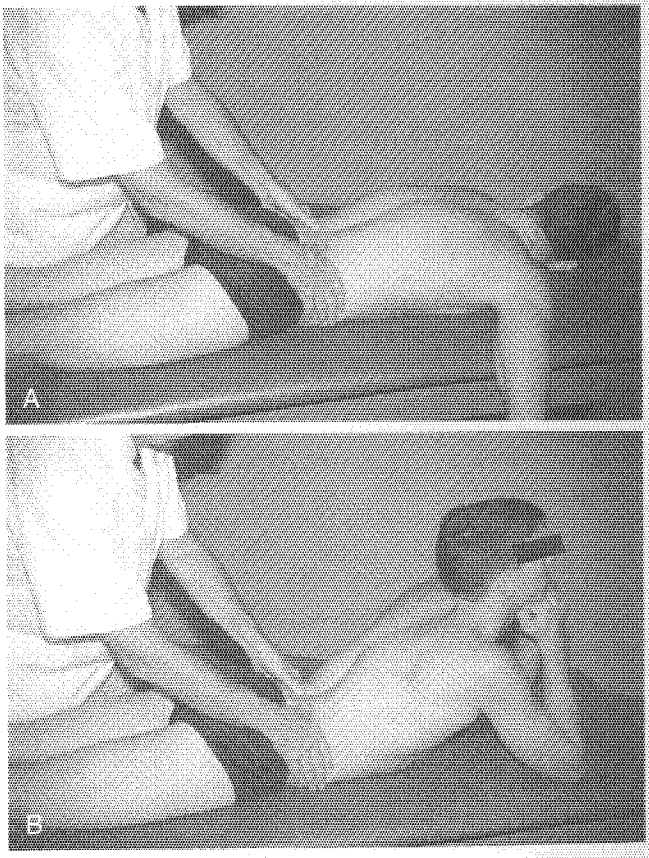

Figure 3. *A*, Palpation of lumbar transverse processes in neutral prone position. *B*, Palpation of lumbar transverse processes in prone prop trunk extension position.

Physical examination is made by palpating the superior aspect of the pubic shelf or pubic tubercle, assessing unleveling against the horizontal plane. If the pubic tubercle is the anatomic landmark chosen, the operator can assess abnormality of tissue texture at the insertion of the inguinal ligament and the rectus abdominis fascia. Tenderness and tension are common findings associated with unleveling against the horizontal plane (Fig. 4).

The clinical significance of pubic dysfunction is associated with altered movement of the right and left innominate bones during the walking cycle. The symphysis is the location of one axis of rotation of the innominates during gait. If dysfunctional, asymmetric innominate movement during gait is present. The second association with pubic dysfunction is muscular imbalance between the major adductor muscle groups below the pubis and the abdominals above. Muscular imbalance is a frequent finding in the failed back population. The incidence of pubic dysfunction was found to be 76%.

Innominate Shear Dysfunction

In 10% to 15% of the population the opposing surfaces of the sacroiliac joints are parallel with each other and have lost the normal sacral concavity and bevel change characteristically found at the level of S2. If the opposing surfaces of the sacroiliac joints are parallel, the possibility of linear shear occurs. The joint depends on its ligamentous integrity for stability. This type of joint is susceptible to trauma, particularly the classic slip and fall and rear end motor vehicle accidents with the foot placed on the brake at impact.* When this shear dysfunction is present, it interferes with all other motions of the associated sacroiliac joint. The symptom presentation of this dysfunction is pain over the lumbosacral region, radiating to the sacroiliac and buttock area and frequently to the posterolateral thigh to the lateral knee. It is a great simulator of radiculopathy. The dysfunction can occur in the superior or inferior direction, most commonly superior.

An index of suspicion of this dysfunction occurs when the iliac crests are unlevel in the unloaded prone and supine positions. The diagnosis is confirmed by assessing the level of the ischial tuberosities and the tone of the sacrotuberous

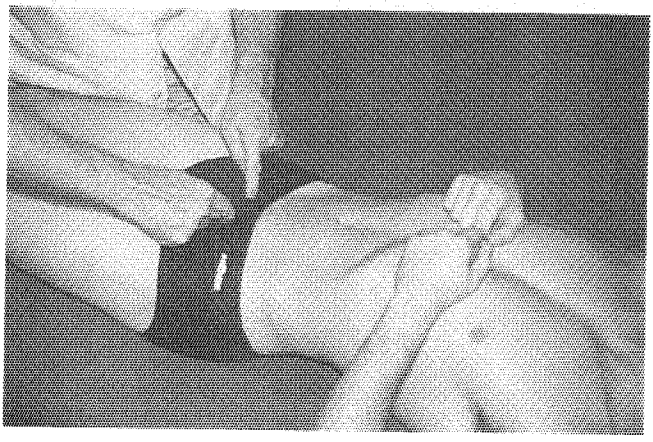

Figure 4. Palpation of pubic tubercle.

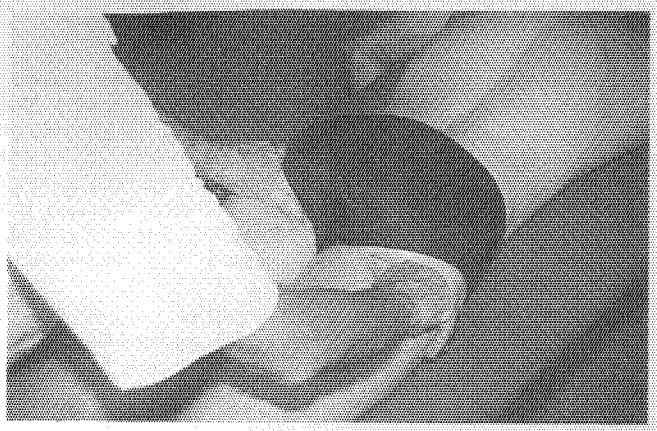

Figure 5. Palpation of ischial tuberosities.

ligaments. With the thumbs palpating the inferior aspect of the ischial tuberosities, unleveling of the thickness of the thumb is viewed as a positive finding (Fig. 5). From the ischial tuberosities the thumbs traverse medially, cephalad, and posterolaterally under the sacrotuberous ligament, sensing equality of tone and the presence of tenderness (Fig. 6). Laxity of a sacrotuberous ligament is present in a superior innominate shear, and increased tension is found in an inferior innominate shear. Dysfunctional sacrotuberous ligaments are frequently tender.

The incidence of innominate shear dysfunction is 15% with a three-to-one ratio of superior over inferior. There is a two-to-one dominance of women over men. Typical of this dysfunction is the magnitude of the symptom with a minimum of traumatic incident and physical findings. The clinician must have a high index of suspicion and be capable of doing the appropriate physical tests to elicit this diagnosis.

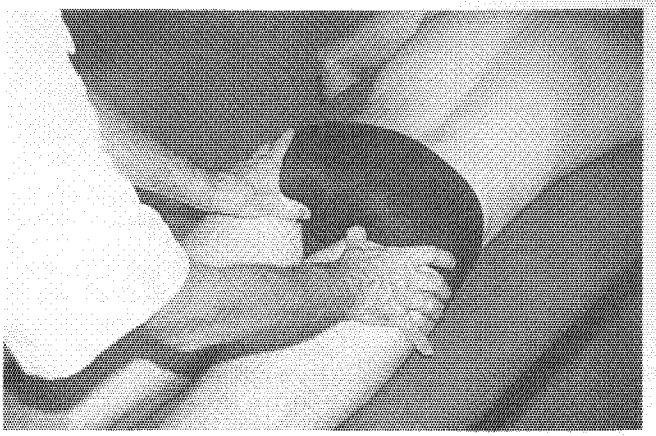

Figure 6. Palpation of sacrotuberous ligament.

Restricted Sacral Nutation

The sacrum between the innominates has the capacity for nodding forward and backward between the innominates across a transverse axis. Nodding forward is called nutation (anterior nutation) and nodding backward, counternutation (posterior nutation). The sacrum also has the possibility of anterior and posterior nutation unilaterally, or as a component part of the torsional (side bending and rotating) motion of the sacrum between the two innominates. Restriction of the capability of the sacrum to nutate anteriorly, unilaterally or bilaterally, or as part of torsional movement has a high incidence in the failed back population.

Assessment of the sacrum's capacity to anteriorly nutate can be done in many ways. One of the best ways is to palpate each sacral base with the index fingers and each sacral apex with the thumbs in the prone neutral position and in the prone prop trunk extension position (Fig. 7). Inability of one or both sacral bases to nutate anteriorly can be identified.

Restricted anterior nutational movement of the sacrum was found in 49% of the population. Fifty-nine percent of the people with this finding had failed previous surgery. This finding frequently is associated with non-neutral dysfunction of the super incumbent lumbar spine.

Muscular Imbalance

Muscular imbalance can manifest in many different ways, including asymmetric tightness, asymmetric weakness, or more importantly, loss of muscle control of the trunk and lower extremities. A simple initial test to assess muscular imbalance is to ask the patient to perform a one-legged stand with the arms crossed and the eyes closed. An individual normally should be able to hold this posture symmetrically for 15 seconds. An inability to do so is evidence of poor muscular coordination. Two simple tests that raise the index of suspicion of muscular imbalance are for the operator to perform a sweeping motion of the hip capsule, beginning at the classic figure four Fabere test, and sweeping into flexion and internal rotation sensing for restriction or a catch-like phenomenon during the maneuver. This assesses the hip rotators, particularly the piriformis, and the balance of the glutei, psoas, and adductors (Fig. 8). Straight leg raising (Fig. 9) is used to assess the length and balance of the hamstring muscles bilaterally. Straight leg raising in this population is more positive for hamstring tightness than for nerve root problems.

Muscular imbalance was found in more than 90% of the patients in this population.

CONCLUSION

Syndromes of the lumbar spine, pelvis, and sacrum have many different terms and descriptors. They are the facet syndrome, mechanical low back syndrome, sacroiliac syndrome, and lumbar disc syndrome. An attempt is made to identify the specific structure involved in the generation of pain. It has been this author's experience that these low back pain syndromes are multifactorial. There consistently has been a high incidence of the dirty half dozen biomechanical dysfunctions identified previously. Fifty percent of the failed back population had three or more of the dirty half dozen. The physician's ability to assess and

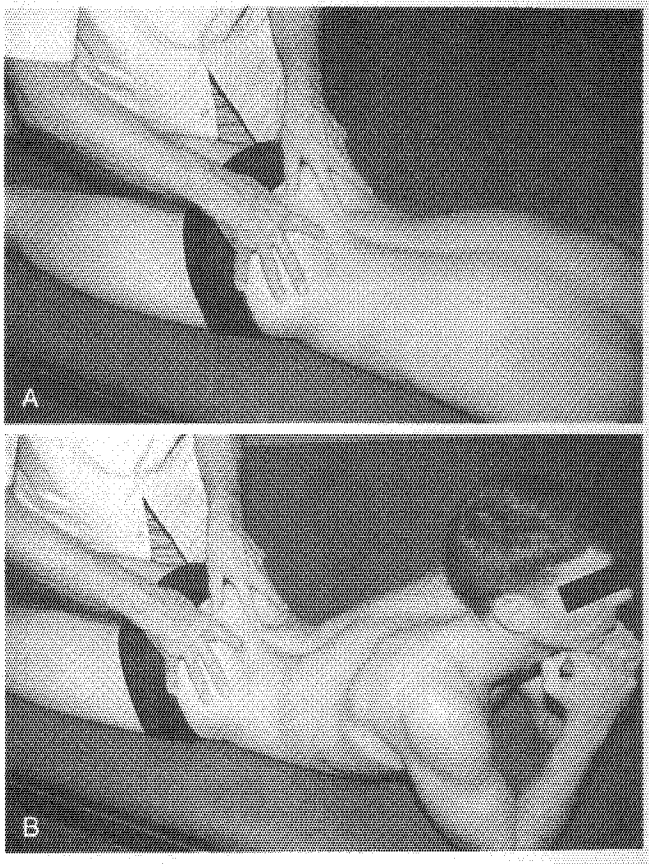

Figure 7. *A*, Palpation of sacral base and apex in prone neutral position. *B*, Palpation of sacral base and apex in prone prop extended position.

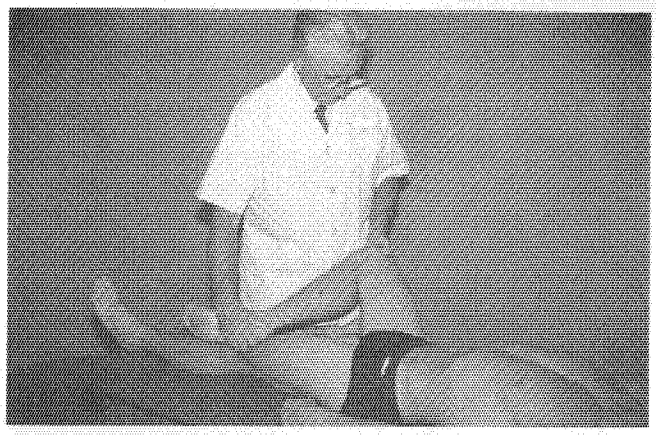

Figure 8. Fabere test and hip capsular test.

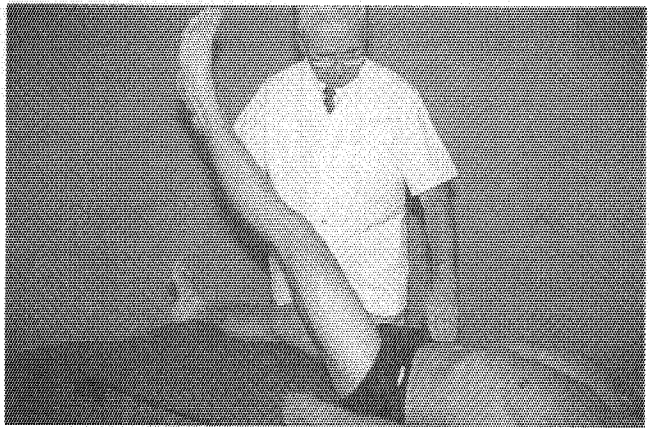

Figure 9. Straight leg raising for hamstring length.

treat the dirty half dozen will assist the management of the failed low back population and if identified and treated during the acute phase, can prevent chronicity.

Of the 183 patients identified with an average disability time of 30 months, an integrated interdisciplinary rehabilitative approach, including manual medicine to the dirty half dozen, restored 75% of this population to normal activities of daily living, including a return to work. It appears that the time and effort to assess patients with back pain for the dirty half dozen are worthwhile endeavors.

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