

Directional Preference Protocol: Centralizing Low Back and Leg Pain

This protocol is performed after the regional ortho-neuro examination. In cases of severe pain, it may be performed earlier, as part of acute pain management.

This protocol, primarily based on work pioneered by Robin McKenzie, presents a system of analysis and treatment in which the spine is loaded dynamically or statically at end range with the goal of identifying specific exercises and procedures that a patient can use in a self-care program. Successful intervention results in changes in pain, resolution of antalgia, and improved range of motion.

More specifically, joints are repetitively loaded at end range or held sustained at end range for a period of time in a variety of positions. Any changes in the quality, distribution and persistence of the patient's pain or improvement in global movement are carefully monitored. In this fashion, a therapeutic loading strategy is discovered and becomes the basis for intervention. According to McKenzie, Donelson and Long, this analysis can help determine the centralization potential of conservative therapies. (Donelson 1990, Donelson 1997, Long 1995, McKenzie 1990)

McKenzie (1990) speculates that low back conditions can be divided into three categories: *postural syndromes*, *adaptive tissue shortening ("dysfunction") syndromes*, and *disc derangement syndromes*.

Postural syndromes are caused by a patient "hanging" on relatively healthy ligaments and other connective tissue for prolonged periods of time, loading them at end range to the point of becoming symptomatic. Postural syndromes have the following characteristics: the pain is intermittent; sustained static end-range loading often brings on the pain over a period of time (e.g., 15-20 minutes); change of position relieves the pain; there is no loss of movement; and there are no symptoms

during specific movements or with repeated movements. (See "treatment" section at the end of this document for recommendations.)

Adaptive tissue shortening (dysfunction) syndromes* are due to contractures, scarring, adherent nerve root causing radiculopathy, myofascial changes and fibrosis. Pain is *immediately* elicited with movement at end range of shortened tissue.

Disc derangement syndromes are thought to be due to intradiscal mass displacement, whether the displacement 1) is into the spinal canal/neuroforamen and associated with radiculopathy (relatively uncommon), or 2) remains an *internal* derangement, associated with local pain and somatic referred pain into an extremity (common). In either case, the symptoms are aggravated during some motions, but movement in another direction—often the opposite—reduces the blockage and provides symptom relief. The discal material is thought to be repositioned, resulting in a rapid reduction of radicular/referred pain and overall improved mechanics. (Donelson 1990, Mooney 1995) Donelson et al. (1997) found that the McKenzie assessment protocol reliably differentiated discogenic from nondiscogenic pain and a competent from an incompetent annulus in symptomatic discs. The protocol was also superior to MR imaging in distinguishing painful from nonpainful discs.

* The term dysfunction as used here is not explicitly linked to the concept of joint dysfunction or subluxation syndrome.

This protocol will focus on a repetitive end-range loading strategy thought to be useful in treating disc derangement/herniation syndromes. However, this approach can be used empirically with other acute or chronic conditions—with or without radiating pain (Long 1995)—even when the exact diagnosis is in doubt.

If the practitioner is unable to identify a directional movement that brings about centralization, decreased symptoms, or improved movement, the treatment procedures in this protocol will be ineffective at that time. The cause of the patient's pain may be a noncontained disc herniation, a treatable disc temporally complicated by significant inflammation, or may not be of discal origin at all. (McKenzie 1998)

CENTRALIZATION, PAIN REDUCTION AND MECHANICAL IMPROVEMENT

The major goal is to identify directional movement(s) and loading strategies that improve the patient's symptoms and mechanics.

Improvement may take the form of any of the following:

- **Change in distribution of lower extremity symptoms.** Peripheral symptoms are reduced and centralize toward the spine.
- **Change in distribution of low back pain.** In patients who present only with LBP, the area of pain shrinks and moves closer to midline.
- **Change in pain intensity or frequency.** The intensity of leg symptoms may decrease, chronic pain may become intermittent, or the frequency of the intermittent pain may lessen.
- **Improved range of motion.** Patients who have an obstruction resulting in decreased movement in a particular direction (e.g., extension) respond with improved range of motion.
- **Improved function.** Patients experience immediate improvement in a comparative baseline activity that has been identified as particularly aggravating (e.g., reduced pain with standing, walking). This activity can serve as an outcome measure.

Once a direction of movement shows promise, this direction is known as that patient's *directional preference* (AKA, *therapeutic bias*, *preferred loading strategy*) and becomes part of the management program, which includes self-treatment. The results of this analysis can be useful in selecting home exercises and identifying vectors for manual therapy. It is important to emphasize that active involvement by the patient is considered essential for a successful outcome. (Jacob 1991, Mooney 1995)

EVALUATION

Patient response to the evaluation can be categorized in the following ways: (Werneke 1999)

- 1) **Symptoms clearly centralize.** Symptoms noticeably retreat from more distal locations toward the spine. For patients who have only central or midline pain, the territory *further* shrinks toward midline and/or the intensity reduces to zero. This improvement is maintained and continues to centralize on subsequent visits. If this process begins on the very first visit, complete symptom recovery is expected and should occur rapidly.
- 2) **Symptoms partially centralize.** Improvement is limited or questionable. For example, the location of the pain only partially centralizes during the evaluation and although it continues to improve over time, it never achieves a midline location during any one treatment; or the patient shows no centralization at all during any treatment, although symptoms appear to be slowly improving over time. Prognosis may still be good, but for slower recovery. However, if the patient's most distal pain does not significantly improve by the 7th treatment, then further treatment with this type of therapy is not likely to be effective. (Werneke 1999)
- 3) **Symptoms do not centralize.** There is either no improvement during the evaluation or the symptoms get worse (e.g., the pain actually peripheralizes throughout subsequent visits). Prognosis is poor for this type of therapy for this patient. However, re-evaluation using this protocol may eventually identify a directional preference.

REPETITIVE MOVEMENTS

The patient loads the spine through a variety of movements and may be asked to repeat each movement up to ten times.

As the patient starts experiencing centralization, the practitioner records at which repetition this happened. Without breaking rhythm, the patient continues the remaining repetitions.

Movements that decrease peripheral pain but seem to increase pain over the lumbar spine are not to be avoided. Repetitions are permitted within pain tolerance under supervision of the practitioner.

If the patient experiences an increase in lower extremity symptoms during these repetitions, the practitioner should, with caution, have the patient *do at least one more repetition* in the same direction and monitor the response. Although rare, the patient's symptoms may peripheralize at first and then centralize.

ROOT ADHESION VS. POSTERIOR DISC DERANGEMENT

The clinician will need to differentiate nerve root adhesions from disc derangement.

- Root adhesions tend to produce intermittent leg pain.
- With adhesions, increased leg pain with forward flexion is generally brief (resolving rapidly after the tension is released).
- Patients with root adhesions may exhibit deviation toward the leg pain during forward bending.
- Symptoms of root adhesions are not aggravated by knee to chest maneuvers.
- Disc derangement symptoms can be intermittent or constant.
- Forward flexion in a patient with disc derangement usually aggravates the symptoms until extension or some other pain-relieving directional movement is introduced.

Note: Patients who experience an increase in pain from the stretching of fibrotic tissues need to be told that this pain is associated with the desired therapeutic outcome.

EVALUATION STEPS

SUMMARY

The following steps should be taken when evaluating the patient:

- Step 1: Anticipate loading strategies based on clues from history.
- Step 2: Try to correct any fixed or antalgic posture.
- Step 3: In patients without a fixed antalgia, explore a single repetition of gross ROM in a variety of directions to establish a baseline of movement, screen for any obvious catches or deviations, and check for centralization or peripheralization of symptoms.
- Step 4: Observe repetitive end-range loading in each of the tested positions.
- Step 5: Evaluate standing and prone extension from a lateral shift position (if necessary).

STEP 1: Anticipate loading strategies based on clues from history.

Identifying postures or movements that relieve and/or aggravate the patient's symptoms may alert the practitioner as to the nature of the condition as well as potential therapeutic loading strategies.

- If pain is not relieved by lying down, consider the possibility of a disease process (e.g., cancer, infection) or chemical pain associated with significant inflammation.
- If patients are made worse when sitting (which introduces a flexion load), but are better standing or walking, consider that they may have an extension bias therapeutically.
- If standing and walking are worse, but sitting is better, they may have a flexion bias.
- If patients are worse sitting and worse walking, they may have a lateral shift problem (which may indicate a more significant posterolateral derangement/herniation that could be potentially made worse by extension or flexion).

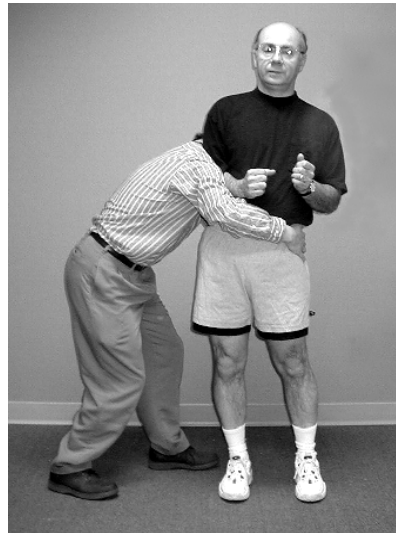
STEP 2: Try to correct any fixed or antalgic posture.

Fixed lateral shift. The practitioner should see if the patient has a fixed lateral shift. If so, this shift needs to be corrected first and, once corrected, extension therapy should begin. Sagittal plane loading should begin first, starting with extension and, if needed, flexion.

Correction consists of either the patient or the practitioner gently and steadily pushing the pelvis back toward neutral into the painful barrier, then gently backing off a few millimeters, and then returning to the new barrier. This process allows the patient to slowly stand up straighter. Continue this procedure by overcorrecting the lateral shift into the opposite direction. If the correction is proceeding successfully, try introducing a few degrees of extension while completing the side glide. If the patient is having great difficulty, try introducing a few degrees of forward flexion.

This maneuver may take anywhere from a few minutes to over 15 minutes. When the over-correction has been completed, it is important that the hand be removed very slowly to prevent a sudden uncomfortable rebound effect. The change may only be temporary, but will allow an opportunity to see if the patient can now tolerate extension. If the shift cannot be corrected, assign the patient homework to continue to try slide gliding or explore the tolerance for prone presses from a lateral shift position. (See Press-Ups with Lateral Shift on Pp. 8-9.) Patients can perform this maneuver for themselves by leaning against a wall. For a right lateral shift, the right shoulder is placed against the wall and the hand presses against the left hip, gliding the entire pelvis toward the wall. If this side glide is successful but the antalgia returns, the procedure will be incorporated into the patient's self-treatment program. (See Standing Side Glide on P. 6.)

NOTE: A lateral shift would be recorded as "left" if the patient's *shoulders* are translated to the left (with the pelvis out to the right).



fixed lateral shift

Fixed lordosis. Proceed directly to therapeutic loading in flexion.

Fixed kyphosis. Give press-ups. If patients have trouble lying in this position, place a small pillow under the stomach.

STEP 3: In patients without fixed antalgia, explore a single repetition of gross ROM in various directions to establish a baseline of movement, screen for any obvious catches or deviations and check for centralization or peripheral-ization of symptoms.

- standing forward flexion
- standing extension
- standing side glide
- supine knees to chest
- prone extension

This first pass is to 1) observe/measure limitations in gross ROM (to establish a baseline), 2) look for painful catches or asymmetrical movement (suggesting possible instability), 3) see if a directional preference immediately presents itself, and 4) observe if pain occurs during movement (consistent with disc injury) or only at end range (suggestive of shortened tissue).

Record patient response.

Patients should report:

- if and where the pain or symptoms have increased or decreased,
- when they feel the change in pain (e.g., during the movement or only at end range),
- whether the pain distribution has changed, or
- whether any obstruction to movement is felt.

Sometimes a directional preference may be immediately obvious (e.g., a patient's leg pain is aggravated by a single flexion and centralizes with a single extension). In such a case, repetitive testing may not be necessary, although confirming the pattern with an additional repetition may be useful because sometimes the pattern changes.

STEP 4: The practitioner will repetitively load the spine in the end range for each of the above positions and directions.

The patient is encouraged to move through the range of motion all the way to end range. The practitioner can also add gentle passive overpressure if necessary.

Record at which repetition the pain occurred, how the quality, location or persistence changed, and how many total repetitions were performed. The record should show that a total of ten repetitions* were performed in each of the directions tested, except in those cases where the movement caused a significant increase in the most peripheral pain, further reduction in gross ROM, or other baseline indicators of radiculopathy.

STEP 5: If the above procedures neither centralize the pain nor improve biomechanics, proceed to the following.

- standing left side glide
- standing right side glide
- prone left side glide
- prone right side glide

* The number 10 is somewhat arbitrary. Usually a symptomatic change can be elicited within that range. At times, a change comes earlier. If the patient is made worse, perform one more repetition *with caution* to confirm. On the other hand, if the symptoms improve, consider continuing up to 10 repetitions to see if the improvement is maintained. If at the end of 10 repetitions, the patient response is equivocal, additional repetitions can be done to try to clarify.

On rare occasion, the practitioner may wish to explore repetitive movements in rotation or lateral bending.

SPECIFIC PROCEDURES

STANDING FORWARD FLEXION

Have patients flex forward from the waist as far as they can, pause and hold the position for a moment, and then return to their starting point. If necessary, they may support themselves by placing hands on thighs. Unless the symptoms peripheralize, repeat this movement up to ten times, resting for a moment and checking for symptom change after each repetition. The practitioner may watch and feel (by placing fingertips on the L4, L5 and S2 spinous processes) to see if any of the flexion is occurring at the lumbo-sacral junction. Record the findings.



standing forward flexion

Methods to ensure appropriate end range:

Encourage the patient to bend “further... further... further” even if it causes some increase in low back pain as long as the symptoms do not peripheralize.

STANDING EXTENSION

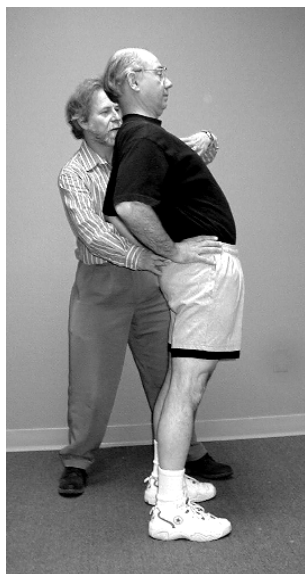
Have patients place palms or fists in the small of the back and extend backwards, using them as a fulcrum. Repeat this same movement into extension up to ten times checking for symptom change after each repetition. Record the findings. In many cases of disc derangement, patients will have reduced ROM and feel a “blockage” to movement, which increases local LBP but reduces leg symptoms. Eventually, the sense of blockage should disappear.



standing extension

Methods to ensure appropriate end range:

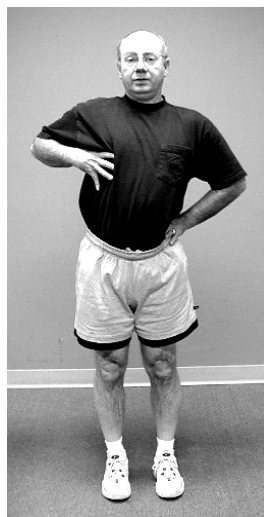
Besides encouraging the patient to go “further...further...further,” the practitioner may wish to place the hands on the patient’s sternum and sacrum to apply gentle overpressure into extension.



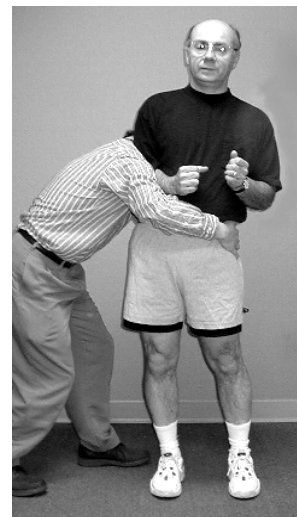
practitioner assisted

STANDING SIDE GLIDE

First try to side glide, moving shoulders toward the side of pain. For example, have patients place the left hand on the left hip, right hand on lower right ribs, then push toward the spine with both hands; hold for a second, then relax this pressure. This movement is called left side glide because that is the direction the shoulders move. The side glides are designed to produce translation. Specific vertebral segments can be evaluated for movement by the doctor by palpating the desired vertebral level as the patient applies pressure. If necessary, the patient can adjust the level at which the maximum movement occurs with slight movements in hand placement positions. Repeat this movement up to ten times, checking for symptom change after each repetition. Record the findings.



standing side glide



practitioner assisted

Repeat the translational movement in the opposite direction ten times by reversing the patient’s hand positions so as to cause right side glide at the desired level. Record the findings. It may be easier for the patient to perform this side glide correction by leaning against a wall.



Methods to ensure appropriate end range:

The practitioner may wish to contact the patient's hip and side to ensure adequate overpressure. Remember, the point of reference for the side glide is the shoulders.

KNEE TO CHEST

Starting with feet flat and knees bent, have patients bring their knees to their chest. The practitioner may assist this movement if necessary. Have patients hold the knees in this position for a full second. Maintaining the bent-knee position, patients then lower the legs, resting the feet flat on the table/floor for a moment before repeating the movement. Repeat this cycle up to ten times, checking for symptom change after each repetition. Record the findings. The last repetition may be held for 30 seconds. Some patients may need more flexion, which can be accomplished by putting a pillow or towels under the upper body and head.



knee to chest

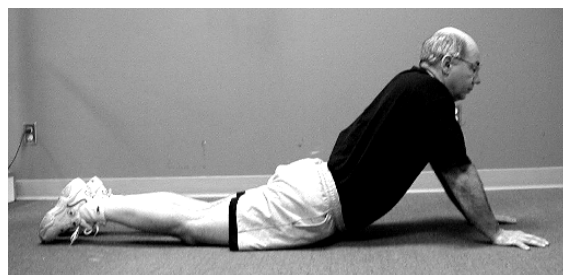
Methods to ensure appropriate end range:

The practitioner may wish to contact the legs just below the knees to apply overpressure through the legs to further apply an end-range load to the spine in flexion.



THE PRESS-UP

Have patients lie prone. Pre-position the legs into internal rotation before attempting the press up. The patient can be instructed to point the knees and toes so that they face each other. Wait a moment and see how patients respond to this change in position. Have them do a press-up, extending the back by rising up on their elbows.



press-up

If patients can do this without peripheralization, they should next try a full press-up in which they extend back until their elbows lock into extension. They should use their arms, keeping their back muscles as relaxed as possible. It may be helpful to instruct them to allow their stomach to sag onto the table. It is important that the gluteus maximus be as relaxed as possible bilaterally.

Have patients hold this posture for a second, allowing the body to adapt to the change of position. Then have them lie back down and completely relax for a moment. Repeat this

movement up to ten times, checking for symptom change after each repetition. Record the findings. The last press-up can be held for 30 seconds.

Methods to ensure appropriate end range:

The practitioner may wish to manually hold (or belt) the sacrum against the table while the patient does the press-up. The practitioner may also test other levels by applying overpressure while the patient is maximally extended. As always, the patient should be exhorted to go further, further and relax the stomach, if possible.



prone extension (partial)

If the patient does not experience pain when lying down, it may not always be possible to detect symptom improvement while remaining in that position. In such a case, after completing the repetitions, place the patient in a posture in which s/he *usually* experiences pain to see if there is any immediate improvement. This “testing” position will usually be standing, but may have to be some other specific position (e.g., sitting) or activity (e.g., walking) that can be used for a baseline comparison. This position or activity may have been identified by a Patient Specific Functional Scale or other assessment tool and can also serve as an outcome measure.

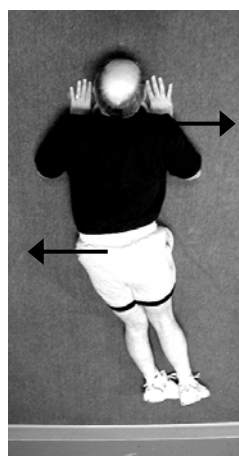


prone extension (full)

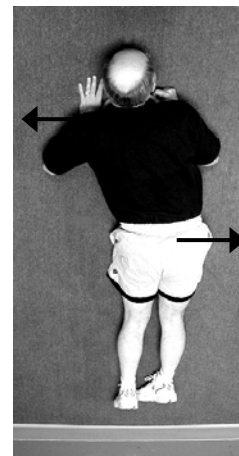
PRESS-UPS WITH LATERAL SHIFT

While lying prone, patients “side glide” their hips in the direction that enhances centralization. If unsure, start by gliding the hips away from side of leg pain. (They may be told to raise their pelvis up, over and down, tracing out the three sides of an imaginary rectangle.) The practitioner may assist, if necessary, by grasping the ASIS and guiding the pelvis up and then over. Then have the patient do a press-up.

If the patient's symptoms have not satisfactorily improved, explore the same translational movement in the opposite direction up to ten times by reversing the patient's hand positions for right-side glide at the desired level. Record the findings.



right glide



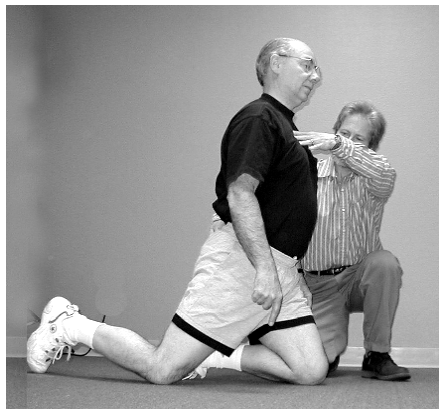
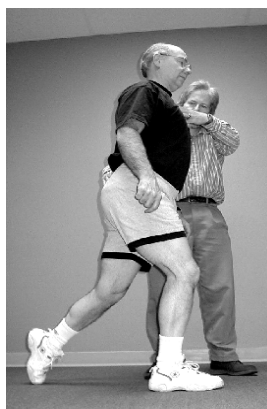
left glide

Methods to ensure appropriate end range:

The practitioner may apply overpressure.

SPECIAL NOTE: If prone testing has revealed a directional preference, it is imperative that the patient maintain the lordosis while making the transition from the floor/table to the upright position and that this exaggerated lordosis also be maintained while sitting at all times. During transition movements, it is recommended to hold an anterior pelvic tilt, maintain abdominal bracing, and flex at the hip when bending forward (i.e., hip hinging). The practitioner may need to support the patient by applying pressure to the sternum and sacrum, locking the patient into lordosis.

Methods to prevent flexion during transition movements:



SUSTAINED SUPINE ROTATION WITH FLEXION

If none of the previous procedures suggest a directional preference, an option is to place the patient on his/her back, with knees and hips maximally flexed. Then while holding or belting the patient flat against the table, maximally rotate the pelvis and legs toward the floor and hold for up to 40 seconds. Rotate to the side of leg pain. As long as this does not peripheralize the pain, repeat 2-3 times.



sustained supine rotation with flexion

TROUBLESHOOTING

If the practitioner is unable to identify a directional preference, consider the following:

- The joints may not have been loaded far enough into end range or *with sufficient repetitions*. Since this sometimes increases the patient's LBP, practitioners may be overly cautious. Likewise, poor treatment response may be associated with the patient's failure to adequately take the exercises to end range. The practitioner should assess the exercise each visit.
- Individual joints may need to be overpressured during the various testing procedures, perhaps in a variety of directions (e.g., try pushing the spinous into right and left rotation while the patient is doing the press-up).
- Overpressure strategies include posterior to anterior pressure on the sacral base, bilateral pisiform pressure on the mamillary processes at various levels, and unilateral pressure on the spinous above and below in opposite directions.
- Since it occasionally takes longer for centralization to occur, try sustained loading in a posture starting with extension for up to three minutes.
- The patient may have so much chemical pain from local inflammation that this entire protocol will need to wait until anti-inflammatory therapy has been successful.

THERAPEUTIC CONCLUSIONS

Upon completion of these movements, the practitioner should have a clearer idea of how to proceed with treatment.

- The practitioner should be able to determine the patient's directional preference—the directions of movement that help centralize the patient's pain, decrease symptoms, or improve mechanics.
- Movements that help centralize pain are incorporated into pain management protocols and given as homework (e.g., 10 repetitions every waking hour in the acute phase).
- The practitioner should be able to determine which directions of movement make the pain worse (*what to avoid*) and those that have little or no significant effect on the pain (*what is safe*).
- Base activity modification recommendations on information regarding movement and direction that cause the least pain.
- The practitioner should be able to tell the patient how rapidly the pain will respond to directional preference: quickly or over a longer period of time.
- The patient's directional preference should help determine which other therapeutic interventions may be warranted, such as flexion-distraction therapy or manipulation along a specific vector.

Keep in mind that patient bias may change with time and therapy; therefore, recheck the patient the *next day* after the initial evaluation and periodically after that, as the situation warrants. In some situations, it may be necessary to check the bias daily to ensure that therapy is appropriate. (Liebenson 1996)

TREATMENT

Clinical trials have found that most patients responding to directional preference loading will have an extension bias (Browder 2007, Long 2004, Kop 1986). Prone press-ups should include a side glide component in the following situations: for patients with a fixed lateral shift seen at presentation, when discovered to be beneficial during repeated testing in cases where extension alone fails, or as a therapeutic trial for patients with an

extension bias and leg pain (the pelvis should be first positioned away from the side of leg pain).

Patients should perform 5-15 repetitions of the exercises hourly or every other hour at first. As symptoms resolve, they can be performed 1 to 2 times a day or more often if symptoms begin to return.

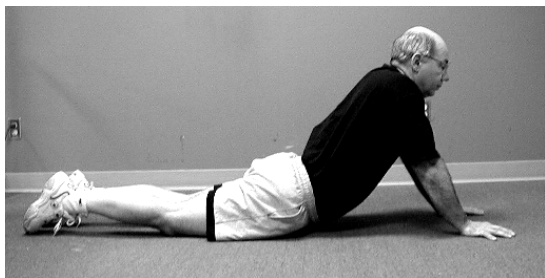
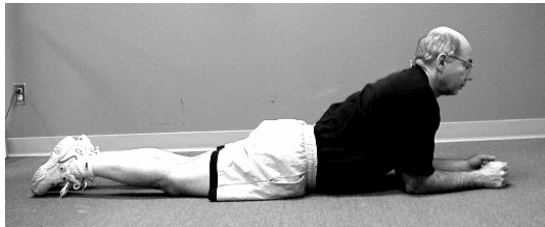
Treatment failure in cases of patients with an extension bias may be linked to insufficient attention paid to the importance of maintaining lordosis during sitting and transitional movements from lying or sitting to standing. A postural support may be necessary to help some patients remember to maintain a seated lordosis.

Sometimes after a disc derangement has been successfully treated, the patient is left with adaptive shortening (a “dysfunction” syndrome). For example, a patient who has been avoiding forward flexion and doing exclusively extension exercises may have lost some ability to flex forward due to shortening of tissue or contraction of a scar. This can often be addressed with appropriate stretching exercises. It is important to finish the flexion exercises with some repeated extension.

FOR SEVERELY ACUTE PATIENTS

In some cases, patients may need to be introduced very slowly to their exercises.

1. Prone, patients lie on the table for 1-3 minutes in a relaxed position. The prone position is maintained until directed otherwise. Some patients may need to start with a small pillow under their abdomen.
2. Patients fold arms under the chest, causing a mild increase in extension of the low back.
3. With palms at shoulder level, patients push up onto the elbows.
4. Patients repeat as above but push up to full-arm extension.
5. End-range loading can be achieved by letting the stomach muscles relax as much as possible.



Alternatively, the patient may do better in a standing position. Standing, patients place hands on their waist and lean back, increasing low back extension.

NOTE: Be prepared to help patients protect themselves when they are leaning backward.

For patients who need flexion, a sitting position may be a good starting choice. Sitting, patients lean forward between knees. They may place their hands on their knees for support when leaning forward or to help themselves return to the upright position. On the last repetition, patients may grasp their ankles and pull their trunk down to increase the flexion in the low back.

POSTURE TRAINING

Problems in posture may slow recovery in those with LBP. The following simple drill may help train patients in proper—and thus symptom relieving—posture.

1. Sitting or standing, have patients slump to experience what poor posture feels like.
2. Sitting or standing, have patients assume a military-like posture—the opposite of the slumped pose in number 1. Have them compare the two positions.
3. Patients alternate between slumped and military posture 4-5 times, finishing in the military pose.
4. Patients then back away from the military pose about 10% to a correct posture.



slump

military-like

correct posture

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