Functional Rehabilitation: Managing Low Back Pain Through Activities-Of-Daily-Living Education

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AFTERTRAUMATO the low back, a decrease in intervertebral joint stiffness can occur, which can lead to inability of the motor-control system to compensate for the tasks imposed on the tissues, resulting in spinal instability. \(^1\) Intervertebral joint stiffness can be thought of as a tightening of a corset around a spine segment, facilitated through coactivation of small and large spinal muscles. The motor-control system might be able to adapt initially with cocontractions of the intrinsic muscles, but an unbalanced demand between the small and large muscles can lead to muscle fatigue and poor task performance. \(^2,3\) The inability of the intrinsic spinal muscles to provide adequate stability might also be the result of improper motor-control skills and damage to the same tissues repeatedly. \(^1\) Activities-of-daily-living (ADL) instruction is a tool clinicians can use to train or retrain patient motor-control skills, thereby increasing spinal stability and reducing direct demand on injured tissues.

ADLs are associated with mobility. Examples of ADLs include getting into and out of bed, transportation, daily living tasks such as household cleaning, and sexual activity. \(^4\) When considering a patient’s needs, the clinician should consider each ADL individually and the impact its specific demands will have on damaged tissues. Educating patients on how to meet their daily demands with proper ADL technique will enable them to perform tasks more efficiently, limit their low back pain, and enhance their recovery.

Mechanical and Tensile Tissue Loads

Applying appropriate stress to damaged structures to foster tissue repair, while avoiding excessive loading of existing structural weaknesses, is a primary goal of rehabilitation. \(^5\) Excessive spinal loading is avoided by attaining and maintaining spinal stability, which requires activation of the motor-control system for appropriate tissue stiffness and joint position. The motor-control system facilitates stability of the joints through muscle coactivation and by placing the joints in positions that contribute to stiffness. A faulty motor-control system can contribute to joint instability leading to joint translation and tissue failure. \(^6\) Increased intra-abdominal pressure bolsters overall stability of the spine. \(^1\) Therefore, when performing ADLs, patients should be instructed to avoid certain positions and maintain an abdominal brace posture to promote core stability.

Patients can achieve sufficient stability of the core with modest levels of coactivation of paraspinal and abdominal muscles. \(^1,6\) Individuals need to respond quickly and strongly to perturbation or spinal loading and adapt appropriately in order to control buckling of the spine. An adequate reflexive response to external loads is needed to help prevent subsequent damage under such sudden loading circumstances. \(^4\) Inappropriate motor-control response by trunk muscles or inadequate stabilization of the lumbar spine to sudden loading can cause low back injury. \(^1,2,6\) A lack
of preparation for perturbations has been shown to contribute to a higher occurrence of low back pain among airline attendants. In addition, individuals with chronic low back pain were found to exhibit delayed motor response of the trunk to sudden loading. This might indicate a risk for sustaining low back injury. Most individuals’ motor-control systems can respond adequately to sudden external demands, even with insufficient trunk stability, but the risk of injury can be elevated when these demands are experienced in specific trunk positions—one being when the spine is fully flexed.

Studies evaluating muscle activation of the core and pelvis have reinforced the old adage: Keep your back straight when lifting. From electromyographic (EMG) study of the quadratus lumborum and erector spinae during flexion–relaxation and other motor tasks, Andersson et al. substantiated the inactive role that the superficial portion of the erector spinae plays in a forward-flexed, relaxed, kyphotic position at a 60–90° hip angle. They found decreased EMG activity through this range and no activity of the superficial medial portion when fully flexed. When the trunk was maintained in neutral alignment (no kyphosis), the superficial medial portion of the erector spinae was active with the quadratus lumborum and deep portion of the erector spinae. Keeping the spine in neutral alignment throughout trunk flexion is encouraged in ADLs (see Figure 1) to promote activation of the superficial erector spinae.

The inactivity of the superficial erector spinae during a relaxed, forward-flexed kyphotic trunk position has been termed the flexion–relaxation phenomenon. The opinion among researchers has been that the spine is stabilized only by passive structures in this condition. As depicted in Figure 2, kyphotic positioning can cause significant intradiskal pressure increases and potential microtrauma to spinal tissues over time, which has been postulated to occur from erector spinae inactivity.

Although commonly used in rehabilitation, active prone trunk-extension movements have also been reported to produce high spine loads. During prone hyperextension testing, the lumbar spine was shown to experience a high compressive load (> 4,000 N) transmitted to the facets, resulting in impingement of the interspinous ligament. This immense compressive force can be practically cut in half (< 2,500 N) through single-leg extension, which activates the longissimus, iliocostalis, and multifidi to increase intersegmental stability. ADL movements initiated later in the rehabilitation program, such as the golfer’s lift seen in Figure 1, make use of the single-leg extension. Tasks involving unilateral leg extension produce a more neutral lumbar position and reduced spinal load because only one side of the lumbar-extensor musculature is contracted. Tasks involving unilateral leg extension appear to constitute a lower risk for individuals with low back injury, given the low spine load and minimal extensor-muscle challenge.

Another trunk movement that comes into question is the sit-up. Moving from a sit-up position to a fully flexed spine (straight or bent knee) involves high psoas activation and significant compressive spinal loading (> 3,000 N), often exceeding National Institute for Occupational Safety and Health guidelines. These high compressive loads are significant to low-back patients who repeatedly rise up from a supine position while holding a relaxed kyphotic posture. In order to work within a safe range of mechanical stability, it has been suggested that patients with low back injury, as well as healthy individuals, avoid these positions and capitalize on positioning and movements that do not tax the motor-control and osteoligamentous spinal-linkage systems. A patient’s common inclination is to sit up from a supine position, but this can be avoided by using a side-bridge movement in the side-lying position, which employs the quadratus lumborum. Use of the quadratus lumborum has been advocated because
of its low compressive forces (<2,500 N) and ability to stabilize the spine in side-bridge movements.

ADL Technique and Education

ADL techniques are not mastered overnight, but through consistent education, they become second nature. Several essential factors among ADL technique are as follows:

- An abdominal brace posture provides stability.
- Healthy large-muscle groups serve as primary movers.
- Kyphotic posturing and bilateral leg and trunk extension are avoided.

The first step in ADL education is to help the patient find a comfortable pelvic position coupled with an isometric abdominal brace. The brace does not have to be strenuous, just provide a modest level of coactivation of the core. Based on my experience, not all patients will be able to perform this first step because of pain, but even these individuals are surprised at how much this exercise helps mediate their pain.

It is advantageous to introduce ADLs early. Essential ones include moving onto and off of a treatment table or bed and a chair or toilet and picking up light objects. All patients, regardless of their condition, will perform these basic movements. The selection and progression of ADL techniques is primarily based on two factors: the patient’s daily needs and ability to perform the ADL movement.

Typically, patients are able to acquire the basic elements of one to two techniques per session but need frequent cuing to remind them to perform the ADL, as well as how to execute it properly. Patients are not introduced to further ADL techniques until they have demonstrated a basic proficiency with previous ones. Determining the most efficient means for an individual to perform an ADL should be an ongoing part of the evaluation and treatment program.

Summary

Avoiding movements, positions, and exercises that place high loads on tissues might help prevent further injury. ADL education prepares patients for the demands of rehabilitation and the unexpected curves life inevitably delivers. If patients are provided ADL education, they will have greater confidence and awareness of their body positioning and how to effectively
move with their injury when performing rehabilitation and daily activities. Coactivation of spinal muscles will also be facilitated, reducing load on healing structures.\textsuperscript{1,2} The benefits patients derive from ADL education will allow them to move back into the fabric of daily life sooner, with less pain, and possibly prevent future injury.

There is a need to study the efficacy of ADL interventions, specifically, their ability to limit tensile forces imposed on injured tissues. In addition, myoelectrical-activation patterns of core muscles associated with ADL movements and their impact on the reduction of back pain should be explored.

\textbf{References}


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