Joint-by-Joint Approach: Mobility

The joint-by-joint (JBJ) approach originating from Gray Cook is one aspect of a larger framework based on Janda's neuromuscular movement function-dysfunction philosophy and research emerging from the "Prague School" of Rehabilitation (Boyle, n.d.; Cook, n.d.). JBJ describes a common pattern of alternating decreased mobility or decreased stability at the joint-complexes (i.e. the joint and all the musculature involved in that joint's movement/control) beginning with the foot and progressing upward through the kinetic chain (Cook, 2010). While these "tendencies" are typically observed, they do not preclude atypical cases; JBJ is a guide, not a "formula" (Cook, 2010).

For example, JBJ noted that both the hip and thoracic spine have a tendency towards decreased mobility (Cook, 2010). Less than optimal functioning at these structures elicit deleterious local and global effects along the articular (postural, kinetic), muscular (synergists, muscle slings, myofascial chains), and neurological (primitive reflexive, sensorimotor system, neurodevelopmental locomotor) chains described by Janda forming the basis for the concepts of systemic compensations (e.g. allostasis), regional interdependence (RI) and referred pain--impacting the biomechanical, neurophysiological, biopsychosocial, and pathoanatomical dimensions (Page, Frank, & Lardner, 2010; Sueki & Chaconas, 2011; Sueki, Cleland, & Wainner, 2013).

JBJ as presented to non-clinicians is a simplified/similar version of Janda's tonic-phasic classifications of muscle imbalance or muscles prone to tightness/shortness or inhibition/weakness (Page et al., 2010). Janda believed that muscle tightness was the primary factor in muscle imbalances; "muscles prone to tightness are one third stronger than muscles prone to inhibition" (Page et al., 2010, p. 50). Furthermore, Janda's observations resulted in the practical common patterns of upper-crossed (UC), lower-crossed (LC), and layer/stratification (regions of alternating tight-weak muscles) syndromes (Page et al., 2010).

Common mobility issues (chronic/oversuse) with the hip/lumbopelvic hip complex (LPHC) and thoracic spine (TS) illustrate Janda's theories.

Hip Mobility

The LPHC is an important keystone structure, "central hub", that transfers force between structures above and below it (e.g. through the vertebral column, the sacro-iliac (SI) joints, to the pelvic girdle, through the hip joints, and down the femurs), acting as a major "fixation point" from where several muscular slings cross/stabilize (Moore, Dalley, & Agur, 2014; Page et al., 2010; Sueki et al., 2013). Commonly "tight" muscles are the hip flexors: iliopsoas (psoas major-minor and iliacus), the main flexor; tensor fascia latae (TFL); and rectus femoris (Brookbush, 2013; Moore et al., 2014).

Any limitations in the hip may promote compensations above or below it as well, or at least provide potential "energy leak"/inefficient performance as in overhead throwing/batting athletes and golf (Cole & Grimshaw, 2016). Shimamura et al. (2015) noted that 30% of baseball pitchers' injuries occurred in the lower body, often related to limited hip mobility; limited hip mobility (rotational range of motion or ROM) also induced increased forces through the glenohumeral joint for greater injury risk. Hip abductor mobility and strength were also necessary to stabilize the pelvis during the pitching stride to efficiently transfer the ground reaction forces (Shimura et al., 2015).

Limited hip joint ROM also affects lumbar spine kinematics (connections through the spine muscles/ligaments, thoracolumbar fascia, zygopophyseal joints, and intervertebral discs), and has been related to (potential precursor of) low back pain (LBP), particularly non-specific LBP (Moreside & McGill, 2012; Wong & Johnson, 2012). Furthermore, articular surfaces of the SI and hip joints (including the over-lying soft tissue) may refer pain to the low back area (Wong & Johnson, 2012).

Avrahami & Potvin (2014) noted that the iliopsoas was a major compressor of the lumbar spine, and key in spinal stablity as it spans from the thoracolumbar area to attach at the femur. While the iliopsoas aids in creating spinal stiffness, "tightness" may interfere with hip extension ROM and/or promote excessive anterior pelvic tilt thus contributing to LBP and altered gait (Avrahami & Potvin, 2014; Liebenson, 2007). Limited hip internal and external ROM has also been related to LBP and SI joint pain possibly due to increased force transmission as seen in golfers, tennis-players, and other rotational sports (McDevitt, Young, Mintken, & Cleland, 2015; Winter, 2015).

Common assessments are a postural assessment for anterior pelvic tilt, the modified Thomas test (ROM hip and/or length-tension of the hip flexors), and goniometric measurement of internal/external rotation in prone position (Wong & Johnson, 2012).

Thoracic Spine

The primary characteristic of TS is that each vertebra articulates bilaterally with the tubercle of its rib-pair; T1 and its ribs attach to the manubrium; T2-T7 and its ribs attach to the sternum; T8-T10 (false ribs) are connected to the sternum via the costal cartilage of the rib above; and T11-T12 are the floating ribs which do not connect to any anterior structure (Menzer, Gill, & Paterson, 2015; Moore et al. 2014). The orientation and slight medial angulation of the facet joints allows limited flexion/extension, but greater degrees of lateral bending and rotation which make the TS an important aspect of rotational movement (Menzer et al., 2015).

Another feature of TS is its relationship to proper scapula congruency (over the 2nd-7th ribs) and kinematics (Moore et al., 2014). Optimal TS posture and mobility are crucial to maintaining the thoracic cavity (and its respiratory structures) and shoulder functionality; changes in TS (such as limited mobility) can affect its local structures with global ramifications (Ekstrum, Black, & Paschal, 2009; Malmström, Olsson, Baldetorp, & Fransson, 2015).

Malmström et al. (2015) found that a slouched posture (forward head/UC) and excessive thoracic kyphosis decreased arm and shoulder ROM and movement velocity; scapula position relative to the thorax seemed impaired.

Ekstrum et al. (2009) noted that decreased TS mobility impacted chest wall and rib cage movement; negatively affected respiration; reduced pulmonary function; promoted weakness/discoordination of respiratory muscles leading to imbalances and inefficient breathing; negatively impacting activities of daily living. A 6-week thoracic stretching and breathing exercise program improved chest wall expansion/function (Ekstrum et al., 2009).

Quek, Pua, Clark, & Bryant (2013) noted that forward head posture and thoracic mobility impairment (excessive kyphosis) were key factors in cervical neck pain and function by influencing cervical ROM (rotation and flexion)--supporting RI. Sangtarash, Manshadi, & Sadeghi's (2015) study of osteoportoic women found that increased thoracic kyphosis resulted in decreased gait performance.

Practical assessment could include Janda's postural analysis and simply watching how a client breathes, noting movement in the chest/diaphragm area (Page et al., 2010).

Closing

To illustrate Janda's principles and the interconnectedness of the human body as a whole system (RI), common mobility limitations presented in the thoracic spine and LPHC demonstrated compensations and/or referred pain above/below the affected structure. In assessment and treatment, the whole system needs to be considered--learn to see both the "forest" and the "tree".

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