Stability Introduction

The joint-by-joint approach is one facet in a larger movement function-dysfunction philosophy by Janda and his contemporaries acknowledging the global-local interplay, interdependence, and contributions between: the articular, muscular, and sensory/neurological chains; and the biomechanical, neurophysiological, biopsychosocial, developmental, and pathoanatomical dimensions of the whole-organism tensegrity system (Cook, 2010; Page, Frank, & Lardner, 2010). "No movement is truly isolated" (Page et al., 2010, p. 27).

Mobility is a precursor for stability. Without proper joint centration and the ability to move well through the entire range of motion (ROM), the stabilizers would be disadvantaged. Stability should not be confused with staticity. Stability is "controlled movement" (Falsone & OTP, 2015). Stabilizers provide local movement control/integrity, supportive tension, and alignment as a basis for movement (Cook, 2010). Stabilizers are reactionary (e.g. reflexive stabilization); Janda identified the importance of neuromuscular and sensorimotor timing as part of coordinated movement (Cook, 2010; Page et al., 2010). Proper functioning of the sensorimotor chain depends on proprioception which may be disrupted/altered in the presence of joint dysfunction and/or pain (Page et al., 2010). Optimal joint function may be disrupted/altered by muscle imbalances which may in turn be influenced by altered movement patterns and/or pain (Page et al., 2010).

Central to Janda's muscle imbalance philosophy is the classification of muscles prone to tightness (muscle length, irritability threshold, altered recruitment) or weakness (stretch/tightness weakness) both of which affect optimal muscle length-tension balance (Page et al., 2010). Common cervicothoracic and scapulothoracic stability issues illustrate Janda's approach.

Lower Cervical Spine, Cervicothoracic Stability

The deep cervical flexors (DCF) or intrinsic muscles of the cervical spine (particularly longus capitis and longus colli with contributions by the scalenes and sternocleidomastoid/SCM), are key to providing stability to the neck--maintaining normal cervical lordosis and adjustment of the vertebrae (Brookbush, 2016; Lee, Park, & Kim, 2013; Moore, Dalley, & Agur, 2014). DCF compress to increase stability, eccentrically decelerate extension, and resist anterior glide of the vertebrae (Brookbush, 2016).

The lower cervical spine (C3-C7) and cervicothoracic junction (CTJ from C7-T) often suffer from decreased stability (Lee, Lee, & Yong, 2014). The CTJ is transitional section of the spine from a normal average cervical lordosis of 40° (mean ROM 35-65° of flexion, 55-85° of extension) to a normal average thoracic kyphosis of 10-40° (mean ROM 25-45° of flexion at 2-4° per segment, 15-20° of extension) (Kuang, Bhatnagar, Yu, & O'Brien, 2008).

Postural deviations such as forward head or FH (upper cervical hyperextension, and lower cervical flexion decreasing the natural cervical lordosis) and Janda's upper-cross (UC) contribute to neck pain (NP) and CTJ instability (Gong, Kim, & Lee, 2011; Lee et al., 2013). FH typically resulted in shortened/overactive (e.g. tightness-weakness) cervical extensors (splenii, upper trapezius, SCM), and lengthened/weakened (e.g. stretch weakness) and delayed activation of DCF (Gong et al., 2011; Kang, 2015; Page et al., 2010; Sakshi, Suman, & Geetanjali, 2014).

Peolsson et al. (2014) studied the effects of three neck postures (FH, flexed head, neutral) on the dorsal neck muscle activity during lifting tasks and found increased extensor (upper trapezius, splenius, semispinalis capitis, semispinalis cervicis, and multifidii) activity in the flexed and FH positions as compared to neutral. Many temporomandibular disorders (TMD) patients were also found to have FH and altered cervical muscle activity; cervical muscle dysfunction impacted masticatory function (Wright, Domenech, & Fischer Jr., 2000). Dimitriadis, Kapreli, Strimpakos, and Oldham (2014) found that chronic NP patients had reduced respiratory strength (decreased lung volume and maximum voluntary ventilation) and altered blood chemistry resulting from neck flexor/extensor strength, NP intensity, and kinesiophobia brought on by pain. Dimitriadis, Kapreli, Strimpakos, and Oldham (2013) noted that inspiration was particularly affected as the SCM, scaleni, and trapezius were common to both cervical and respiratory function.

These examples illustrate regional interdependence; a postural issue can have significant impact. Postural assessment is the most expeditious way to spot potential CTJ problems.

Scapula, Scapulothoracic Stability

Scapular stability and congruency to the thorax is important as it promotes the proper functioning of the rotator cuff muscles; therefore, proper scapula mobility is essential to scapulothoracic stability (Provencher et al., 2014). The scapula is a keystone structure that rests on the posterolateral thorax (with a superomedial angle of 124-162°) atop ribs 2-7, and serves as an origin/insertion site for 17 muscles (Frank, Ramirez,Chalmers, McCormick, & Romeo, 2013; Page et al., 2010).

Normal scapula motion includes: protraction/retraction; upward/downward rotation; anterior/posterior tilting; internal/external rotation; and superior-inferior translation corresponding to clavicular elevation-depression (McClure, Greenberg, & Kareha, 2012; Provencher et al., 2014). The upper and lower trapezius and serratus anterior (SA) control most of the upward rotation; the lower fibers of SA and lower trapezius produce posterior tilting; the middle trapezius produces external rotation (McClure et al., 2012). Scapulohumeral rhythm (coordination of humeral-scapulo elevation, ratio 2:1) is important, and may be disrupted/altered by any imbalance among the 17 muscles (Provencher et al., 2014). The vulnerable scapulothoracic joint is commonly plagued with stability and mobility issues from dyskinesis.

Laudner and Williams' (2013) study involving collegiate swimmers found increased latissimus dorsi stiffness pulling on the scapula's inferior border superiorly and laterally during humeral elevation. Increased upward rotation or increased posterior tilt as been related to subacromial impingement and internal impingement respectively (Laudner & Williams, 2013).

Scapular dyskinesis is also associated with rotator cuff disease, labral tears, anterior capsule laxity, glenohumeral internal rotation deficit (GIRD due to increased external rotation and a 20-25° deficit of internal rotation), and general shoulder instability particularly for overhead/throwing athletes (Provencher et al., 2014). Even postural deviations such as UC/FH may have a deleterious effect on scapular kinematics--decreasing shoulder abduction by 23.6° with a 16.2% force decrease at 90° of abduction due to increased superior translation and reduced upward rotation and posterior tilt (Provencher et al., 2014). A shortened pectoralis minor also contributes to increased anterior tilting and protraction (Provencher et al., 2014).

Postural/visual-dynamic assessment is effective for evaluating scapular dykinesis. For example, winging of the medial border was observed in individuals with increased internal rotation; inferior angle winging was associated with decreased posterior tipping; winging and anterior tipping were common to serratus anterior weakness/fatigue (Huang, Ou, Huang, & Lin, 2015).

Closing

Cervicothoracic and scapulothoracic stability problems illustrate Janda's muscle imbalance theory and the interconnectedness of the human body.

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