Chung–M2 Regional Interdependence

Note: I am not currently practicing in the health/fitness field; I do not have any case studies. I borrowed my friend to use because he has a long history of injuries. I know that his particular case may not directly relate to the regional interdependence reading in this module. I am hoping it still fits the general idea. This is presented from the scope-of-practice of a personal trainer.

Regional interdependence (RI) simply means that the body functions as a system, and that all parts of the system (whether in dysfunction or not) are interconnected (e.g. asymmetries, compensations, faulty movement patterns, pain) (Cheatham & Kreiswirth, 2014; Page, Frank, & Lardner, 2010; Sueki, Cleland, & Wainner, 2013). The RI approach calls clinicians to look beyond the "obvious"--move away from the structuralists/biomechanists' localized viewpoints by looking broader or systemically (moving towards the neuromuscular approach). Regions seemingly unrelated and distal to the primary source of pain may indeed contribute to the pain/dysfunction (Cheatham & Kreiswirth, 2014; Sueki et al., 2013).

Name: ClientY

Age: 37 years old

Date of Injury: 2014

Sport: Multi-sport athlete (including karate, Brazilian Jiu Jitsu, and golf).

Diagnosis (Medical):
Activity-induced left medial knee discomfort stemming from limited range of motion (ROM) in ipsilateral hallux from a 1 year old, fractured 1st phalanx, and torn 1st metatarsophalangeal (MTP) joint capsule.

Subjective (S):

History:

ClientY is an average-lean mesomorph at 6 feet tall and 212 pounds whose career demands a high level of physical activity. He is a personal trainer, karate instructor, Titleist Performance Institute fitness professional Level 2, Brazilian Jiu Jitsu athlete, and ex-semiprofessional football player.

Previous injuries include: multiple concussions; broken nose; fractured jaw; sprained neck; broken clavicle; 3 left shoulder sprains; hyper-extended right elbow; fractured right wrist; fractured right fourth finger; multiple dislocated fingers on both hands; low back strain; bruised right knee cartilage; sprained left ankle; torn left medial collateral ligament; right and left patellas fractured; broken left 5th toe; fractured 1st phalanx and torn 1st metatarsophalangeal (MTP) joint capsule in left hallux; and lost right hallux toe nail.

Chief complaint:
Limited ROM of the left hallux (lost 10-12 degrees from normal end-range of dorsiflexion).
Sore knee from activities pushing the end-range of left hallux dorsiflexion.
Tight hips (needs to loosen for martial arts).

Objective (O):

Functional status:
Unable to lunge/split squat due to injured left hallux ROM and knee stress/pain.
Occasional difficulty/discomfort squatting.
Unable to kick (karate) leading with forefoot/ball of foot (must modify round-house and front kicks).

Systems review:
Chronic conditions include asthma (infrequent episodes; rarely interferes with activities; no pharmaceutical intervention) and migraines (started 16 years ago). No other significant systemic issues.

Physical status:
Limited ROM in left hallux dorsiflexion.

Assessment (A):

Tests and measures:
ClientY has a slight anterior pelvic tilt and forward-head (slight upper-crossed syndrome).
ClientY has a slight intoe gait (functional adaptation from football).

Plan (P):
As suggested by classmate Jennifer McKinnon, I would refer ClientY out to a manual therapist (or self-perform some massage) for deep massage of flexor hallucis longis and deep posterior compartment of the leg; 1st MTP joint mobilizations; sesamoid mobilizations; and dorsal interossei release (Fond, 1984; Shamus, Shamus, Gugel, Brucker, & Skaruppa, 2004). I would also work on his intoe gait since he is no longer playing football professionally (i.e. the adaptation no longer serves any purpose) and his posture.

RI Application

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Regional interdependence or as Page et al. (2010) described global compensation for local destabilization via altered movement patterns is an applicable model in practice. ClientY's anterior pelvic tilt and forward-head could elicit compensations elsewhere especially as the pelvis is a keystone structure (Page et al., 2010). Anterior tilting is associated with tight hip flexors (functional postural chain) (Page et al., 2010).

Intoe gait, a functional adaptation developed from years of playing football, provides less medial foot-roll, stiffer ankle joint translating into less energy absorbed/dissipated upon ground impact/footwork for faster cutting (Young, 2008). Intoeing, occurring most often in children, may result from several factors including internal tibial torsion (knee forwards, feet inwards, increasing tibial torsion) and internal femoral torsion (femoral anteversion) (Croydon Health Services, 2012). Whether ClientY's intoeing is tibial or femoral dominant, the kinetic chain is linked and both tibial/femoral promote knee valgus, anterior knee pain, knee/hip osteoarthritis, and other pathologies (Kulig, Harper-Hanigan, Souza, & Powers, 2010; Running Reform, 2013). While intoeing is a functional sports movement pattern adaptation, it potentially may cause global compensations affecting multiple muscle slings when considering the tibia, femur, and pelvis keystones (Page et al., 2010).

ClientY's left "turf toe" has limited his passive and active hallux dorsiflexion range of motion (hdROM). The capsular ligamentous sesamoid complex of the 1st MTP sustains 40% to 60% of body weight during normal gait; athletic activities increase the load by 2-8 times body weight (Childs, 2006; McCormick & Anderson, 2009). The flexor hallucis longus tendon's passage goes behind the tibia, under, and inserts into the 1st distal phalanx--its passage goes right under the area of most pressure from body weight (Earls & Myers, 2010). Assisting with hallux function are the extremity flexor/extensor slings: extensor/flexor hallucis longus, tibialis anterior, peroneus longus (inserts into the 1st metatarsal), and the local retinaculum (dense fascia "crural sock" acting as a supporting covering) (Childs, 2006; Earls & Myers, 2010; Page et al., 2010). Earls & Myers (2010) described primary/secondary "arches/curves" [throughout the body] (acting as springs, maintained by tension) starting from the toes/ball-of-foot going upwards. These secondary curves (spanned by the superficial back line) are maintained primarily via the balance of soft tissue as opposed to the bones (Earls & Myers, 2010).

The mobility and stability of the first ray is important in the transference of force up and down the kinetic chain (Glasoe, Yack, & Saltzman, 1999; Splichal, 2015). The hdROM is critical to gait especially at the MTP joint where sliding, gliding and jamming occur for successful hallux push-off (Splichal, 2015). A rigid first ray can cause restrictions in tibial internal rotation, and a malrotated tibia may cause various knee pains (Glasoe et al., 1999).

To summarize, the human body is interconnected by articular, muscular, and neurological chains (Page et al., 2010). Local destabilization may likely result in global compensation via feedback/feed-forward mechanisms and altered movement patterns (Page et al., 2010). Hallux 1st MTP pain/limited ROM influences: altered proprioception, altered balance, positional compensations (pain avoidance and relief); ankle stability/position (pain avoidance) which can alter posture/gait/movement patterns from knee-lumbopelvic hip complex and spine.

References

Cheatham, S. & Kreiswirth, E. (2014). The regional interdependence model: A clinical examination concept. *International Journal of Athletic Training & Therapy, 19*(3), 8-14.

Childs, S. (2006). Pathophysiology. The pathogenesis and biomechanics of turf toe. *Orthopaedic Nursing, 25*(4), 276-282.

Croydon Health Services (2012, March 31). Intoeing in children: A guide for parents and carers. Retrieved from http://www.croydonhealthservices.nhs.uk/Downloads/GP_resources/Referral%20and%20service%20information/Podiatry/Intoeing%20factsheet.pdf

Earls, J., & Myers, T. W. (2010). *Fascial release for structural balance*. Chichester, England: Lotus Pub.

Fond, D. (1984). Flexor hallucis longus tendinitis - a case of mistaken identity and posterior impingement syndrome in dancers: Evaluation and management. *Journal of Orthopaedic & Sports Physical Therapy, 5*(4), 204-206.

Glasoe, W., Yack, H., & Saltzman, C. (1999). Anatomy and biomechanics of the first ray. *Physical Therapy, 79*(9), 854-859 6p.

Kulig, K., Harper-Hanigan, K., Souza, R., & Powers, C. (2010). Measurement of femoral torsion by ultrasound and magnetic resonance imaging: concurrent validity. *Physical Therapy, 90*(11), 1641-1648.

Macrum, E., Bell, D. R., Boling, M., Lewek, M., & Padua, D. (2012). Effect of limiting ankle-dorsiflexion range of motion on lower extremity kinematics and muscle-activation patterns during a squat. *Journal Of Sport Rehabilitation, 21*(2), 144-150.

McCormick, J., & Anderson, R. (2009). The great toe: Failed turf toe, chronic turf toe, and complicated sesamoid injuries. *Foot & Ankle Clinics, 14*(2), 135-150.

Page, P., Frank, C. C., & Lardner, R. (2010). *Assessment and treatment of muscle imbalance: The Janda approach*. Champaign, IL: Human Kinetics.

Running Reform. (2013, April 4). Femoral anteversion, Craig's test and poor advice - Running Reform. Retrieved from http://runningreform.com/femoral-anteversion-craigs-test-and-poor-advice/

Shamus, J., Shamus, E., Gugel, R., Brucker, B., & Skaruppa, C. (2004). The effect of sesamoid mobilization, flexor hallucis strengthening, and gait training on reducing pain and restoring function in individuals with hallux limitus: A clinical trial. *Journal of Orthopaedic & Sports Physical Therapy, 34*(7), 368-376 9p.

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Splichal, E. (2015, July 21). Great toe mobility: The linchpin to movement longevity, part 1. Retrieved from http://barefootstrongblog.com/category/barefoot-biomechanics/

Sueki, D. G., Cleland, J. A., & Wainner, R. S. (2013). A regional interdependence model of musculoskeletal dysfunction: Research, mechanisms, and clinical implications. *Journal of Manual and Manipulative Therapy, 21*(2), 90- 102.

Young, M. (2008, May 7). Why are so many gifted athletes pigeon-toed? - ELITETRACK. Retrieved from http://elitetrack.com/blogs-details-3820/