24/06/2015 Short case Report (With kind permission from the client)

Case study of a 64 year-old gent. 180 cm height, 105 kg body mass.

Presented with a chronic right-sided neck pain and occipital headaches over many years, which were activity related. Other symptoms included bilateral lower limb muscle aches and mild right side LBP.

Although there were a number of morphological/structural and temporal changes to the parameters of his gait as you can imagine observing his pelvic obliquity, I will focus on the changes around the neck and shoulder.

I established that this was a bony (structural) difference in leg length by using the 'Pelvic Equilibrium Theory' clinical protocol, which quantifies pelvic behaviour during functional trials. On arrival to the Sub-4 gait centre his right innominate inclination was a -2°, and 10° +ve on his left creating a 12° pelvic torsion. Using normative values of approximately 8 – 10° +ve, he presented with a PI ilium on the right side (See glossary link below). The pelvic torsion reduced to 2° with a left 15 mm foot raise platform (intervention) and increased to 14° with a right foot raise platform.

The techniques I used to establish that the LLI was a bony/structural difference without X-scanning equipment:

> Firstly, the sacral base levelled and the pelvic torsion reduced considerably with a left foot raise platform. Therefore the pelvic torsion was compensatory because it could be reduced and increased, with and without intervention respectively. Moreover, if the LLI was an

apparent different (not structural) due to a subluxation at SIJ or lumbar level the pelvic torsion would not have reduced so easily and the patient would have felt worse/awkward with the intervention under the shorter limb. Using a raise platform in the case of a subluxation would have created a potential risk to lumbar discs.

Secondly, I was able to level the sacral base; reduce the functional scoliosis and mal-aligned neck by using a total raise platform of 25 mm. We know that a maximal AS ilium orientation can raise and externally rotate the acetabulum by 4-6mm, and a maximal PI ilium orientation can lower and internally rotate the acetabulum by 4-6 mm (See Clarence Gonstead ref below). That said, they would have to occur together, which would be a rare event along with all other multisegmental parameter of the kinetic chain being even – which often they are not. Therefore any LLI in stance alone of >12 mm would have to have a true bony structural element to it.

This is why I often comment that:

- In stance any LLI can be a combination of:
  - a true bony structural asymmetry, or
  - an apparent LLI (subluxation creating pelvic torsion, and therefore pelvic obliquity).
- In gait any LLI can be a combination of:
  - a true bony structural asymmetry, or
  - an apparent LLI (subluxation creating pelvic torsion, and therefore pelvic obliquity), or
  - a functional LLI (a difference that only appears during function).

This gent had pain and discomfort in his right semispinalis capitis, splenius capitis in his neck and occipitofrontalis around his right rear head region. With my moderate knowledge of cranial mechanics I have assessed that these issues could well have been created by the need for the head and centre of mass (CoM) to maintain what I call the 'Essential T' (a line drawn from a vertical head to the CoM below and a perpendicular horizontal line drawn through the eye i.e. cerebellovestibular balance). The headaches were

possibly due to asymmetry in function of said muscles and the posterior oblique sling, which would explain the pattern of symptoms.

Orthoses Intervention & gait training.

The gent was dispensed a pair of bespoke orthoses:

- Polypropylene
- Moderate arch profile
- Neutral at the rearfoot (due to medio-lateral sinusoidal instability)
- Full length cover
- Poron arch fill for pronation deceleration etc.

The patient reported being comfortable before he left the surgery. I will review him in two weeks unless required before. He was given a few simple gait tips.

NOTE: A new suggested classification for LLI, as so many are confused by a variety of terms

However, LLI can be further subdivided into three aetiological groups: a *real* bony LLI (R LLI) where bony structures have a diference in length and size on one side of the body when compared to the other; an apparent LLI (A-LLI) where pelvic torsion between each innominate alters the relative height and position of the acetabulae creating a difference in leg length, which is reduced when pelvic torsion is reduced; and a third least recognised type which exists only during function due to increased flexion of one ankle, knee and hip joint or unilateral foot collapse (F-LLI). The complexities of LLI means that rarely does a singular type of LLI exist in isolation. Often at least two types of LLI are present in any posture and can be difficult to differentiate between the different types for clinical purposes.

Real bony LLI (R–LLI)

R-LLI, also known as *structural* or *true* LLI is defined as a difference in leg length as a result of one bone being structurally different length to another.

The aetiology of R-LLI can be *congenital* or *acquired*. Of the congenital causes, the most common include congenital dislocation of the hip, a congenital hemiatrophy or hemihypertrophy with skeletal involvement. Acquired can be as a result of fractures, infections, paralysis, tumours, radiation, surgical procedures such as prosthetic hip replacement, and mechanical such as slipped capital femoral epiphysis. However, the vast majority of patients with R-LLI have no known aetiology, which arises during normal growth without any apparent pathology. This occurs where two corresponding bones, e.g. the femurs have grown out of phase with each other and remains present into adult life. Compensation for R–LLI often occurs at pelvic level in the form of pelvic torsion, and is differentiated from A–LLI by the fact that once any pelvic torsion is eliminated there would still be a measureable difference in leg length.

Apparent LLI (A–LLI)

A-LLI, is defined as a leg length inequality as a result of asymmetry between the innominates in relationship to each other, creating a pelvic torsion, but when the pelvic torsion is reduced the leg would measure the same or very close to being the same length. Pelvic torsion occurs when either one or both innominates are rotated either anteriorly or posteriorly at the sacroiliac joint relative to the other but away from their normal sagittal plane orientation (C Bradeley 8 to 10 ° +ve). During an anterior rotation of an innominate there is a corresponding displacement of the acetabulum in an external and superior direction raising the iliac crest if assessed during stance and gait creating a difference in leg length. However, this motion also lowers the ASIS during the forward rotation of the innominate so that when leg length is measured from

the ASIS to the medial malleolus with the patient lying supine on a couch, the ipsilateral limb would measure shorter, than if it was in its normal orientation (Don Tigny 2005).

The opposite is true when an innominate is rotated posteriorly. There is also a corresponding displacement of the acetabulum but in an internal and inferior direction lowering the iliac crest, if assessed during stance and gait. However, this motion raises the ASIS during the posterior rotation of the innominate so that when leg length is measured from the ASIS to the medial malleolus with the patient lying supine on a couch, the ipsilateral limb would measure longer than if it was in its normal orientation. McCraw, (1991) calls an A-LLI aetiology 'functional' and F-LLI 'environmental', for example when someone runs along a chambered surface. A-LLI is differentiated from R–LLI by the fact that once any pelvic torsion is eliminated both legs will measure the same or very similar in length.

Functional LLI (F–LLI)

A F-LLI only occurs when regardless of other causes the most dominant factor creating the LLI is due to asymmetry in function of one *limb* compared to the other, in a way which lowers the pelvis on one side. A F-LLI only exists during function and can be identified kinematically. Causes of F-LLI include unilateral excessive pronation or supination of a foot; increased ankle, knee or hip joint flexion; early or delay heel lift. Other causes include unilateral limb adduction or abduction. F–LLI often occurs with the other two types of LLI, which makes clinical identification confusing and difficult.

Links & reference

1. Glossary link:

http://www.biomechanicsacademy.com/a-glossary-to-use-with-the-pet/

2. Gonstead Chiropractic Science & Art. Clarence S. Gonstead. Sci-Chi Publications. 1980
3. McCaw, S. and B. Bates (1991). "Biomechanical Implications of Mild Leg Length Inequality." Br J Sp Med **25**(1): 10 - 13.
4. DonTigny, RL: Critical analysis of the functional dynamics of the sacroiliac joints as they pertain to normal gait. J of Orthopaedic Medicine (UK) 27:3-10, 2005
5. DonTigny, RL: Pathology of the sacroiliac joint, its effect on normal gait and its correction. J of Orthopaedic Medicine (UK) 27:61-69, 2005

To further discussion of similar cases please visit:

https://www.facebook.com/groups/634382746662608/