Clinical Practice Guideline	**Functional Leg Length Assessment**
Date of Implementation:	**July 13, 2006**
Product:	**Specialty**

GUIDELINES

American Specialty Health – Specialty (ASH) considers functional leg length assessment unproven for the purpose of validating subluxation (segmental joint dysfunction). It is not established as having diagnostic utility. Due to the extent of variability in specificity and reliability of observation (subjectivity), this procedure cannot be relied upon to definitively diagnose mechanical dysfunction.

DESCRIPTION/BACKGROUND

When a subject lies prone or supine, the feet are examined for the presence of a "short leg" or alignment asymmetry. This *functional* leg length inequality (LLI) is in contrast to *anatomical* leg-length inequality in which there are actual differences in the length and geometry of the osseous structures of the lower extremity. The theory behind leg length analysis is that various spinal misalignments (subluxations) or other biomechanical disorders will manifest as changes in functional leg length.

The most commonly used procedure involves the patient lying prone on the adjusting table. After a series of movements and maneuvers designed to eliminate any false findings, and after applying a slight cephalad pressure on the feet, the relative position of the patient's heels is compared. Additional maneuvers are typically performed, including flexing the legs to 90^o, rotating the head, and applying pressure at various points on the spine (challenges) while observing changes in LLI.

The evaluation of LLI is predicated upon the occurrence of changes in functional leg length that result from pelvic distortions. The posterior rotation of the innominate bone at the sacroiliac joint is believed to result in swinging the acetabulum superiorly relative to the opposite acetabulum. The leg on the side of the superior acetabulum is thereby caused to be functionally short. Other theories posit that muscular imbalances, rather than articular dysfunction, result in a functionally short leg (Cooperstein & Gleberzon, 2004).

The evaluation of LLI is also used by some practitioners as an outcome measure. Upon the administration of a particular corrective procedure, the leg lengths are re-checked and, if the inequality has vanished, it is presumed that the underlying disorder has been resolved.

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EVIDENCE REVIEW

There are several challenges to interpreting the scientific evidence on functional leg-length assessment. The first is that there is no consensus on the method of analysis or on the interpretation of results. Several different systems employ some variation of LLI testing; each with their own interpretation of the results.

Additionally, there are three levels of scientific evidence necessary to evaluate this procedure:

1. *Reliability*. Can the same or different examiners obtain the same findings on repeated measures of the same subject?
2. *Validity*. Do the leg length differences found actually reflect real functional differences in leg length?
3. *Clinical utility*. Do the findings of functional leg length differences and the subsequent therapeutic decisions that follow result in improved patient outcomes?

Reliability

The evidence on reliability is mixed. Cooperstein et al. has shown that when LLI is artificially created for the purposes of evaluating testing procedures, a very high degree of reliability can be achieved (Cooperstein, Morschhauser, Lisi, & Nick, 2003). However, the evidence does not support the finding that it is possible to differentiate functional from anatomic LLI. Other studies on intra- and inter-examiner reliability have found varying degrees of concordance, but many of the positive results have been called in to question over methodological and analytical deficiencies of the studies. Overall, the literature suggests that it should be possible to achieve a reasonable level of reliability, although inconsistencies in methods, training, and experience have not resulted in a reliable procedure (Cooperstein & Lisi, 2000; Friberg, 1983; Gross, Burns, Chapman, Hudson, Curtis, Lehmann, & Renner, 1998; Hoikka, Ylikoski, & Tallroth, 1989; Jansen & Cooperstein, 1998; Knutson, 2005; Knutson, 2005; Rhodes, Mansfield, Bishop, & Smith, 1995; Soukka, Alaranta, Tallroth, & Heliovaara, 1991).

Validity

Are functional LLI findings real? Cooperstein et al. argues that in order for the pelvic torsion to occur to a sufficient degree to produce a measurable LLI it would be necessary to totally disrupt the symphysis pubis; if the sacro-iliac joint movement is occurring so as to produce LLI, motion must also be occurring at the symphysis which could not occur without significant structural damage (Cooperstein et al., 2003). Many would also argue that there is not even sufficient potential sacro-iliac motion necessary to produce pelvic torsion and thereby an LLI.

There are also theoretical problems with a muscular-imbalance mechanism of LLI. *If* muscular hypertonicity caused LLI in an unloaded position (prone or supine) and if the pelvis itself remains in normal alignment, then upon assuming weight bearing position the

LLI must vanish; to do otherwise would require, “picking up one’s leg by the bootstraps.” Knutson has concluded that at least in the unloaded position, it is likely that functional LLIs do exist.

Clinical Utility

A review of the literature concluded that the prevalence of anatomic LLI (as identified on x-ray) was 90% with a mean difference in length of 5.21 mm. The review concludes that there is no likely clinical significance for these very small differences in leg-length (Knutson, 2005; Knutson, 2005). It further concluded that anatomic LLI must reach 20 mm (about 3/4”) to become clinically meaningful. However, there is essentially no information indicating that functional LLI (if it exists) is associated with clinical back pain or other complaints. There is also no evidence that therapy directed by findings of the Derifield leg check, or any other similar procedure will improve clinical outcomes. (Please note that this represents an absence of evidence, rather than evidence of ineffectiveness.) Despite the above findings, Havran et al. (2016) presented an article on leg length discrepancy (LLD) with an algorithm outlining approaches to diagnosis and management of LLD in older adults, along with a representative clinical case. Using a modified Delphi approach, the LLD evaluation and treatment algorithm was developed by a multidisciplinary expert panel representing expertise in physical therapy, geriatric medicine, and physical medicine and rehabilitation. The materials were subsequently refined through an iterative process of input from a primary care provider panel comprised of VA and non-VA providers. Authors believe that in older adults, LLD can be an important contributor to CLBP. They believe that to promote a patient-centered approach, providers should consider evaluating for leg length discrepancy when treating older adults with CLBP to help diminish pain and disability, regardless of previous insufficient findings to support LLD as a cause of low back pain.

Applebaum et al. (2021) completed an overview and spinal implications of leg length discrepancy (LLD) in a narrative review. LLD occurs when the paired lower extremities are unequal in length and can be etiologically classified as functional or structural. Length differences are typically less than 10 mm and asymptomatic or easily compensated for by the patient through self-lengthening or shortening of the lower extremities. LLD can be assessed directly through tape measurements or indirectly through palpation of bony landmarks, but poor validity and reliability of these measures exist. Imaging modalities, specifically radiography, are more precise and help identify coexistent deformity. Once LLD has been diagnosed, evaluation for potential adverse complications is necessary. Discrepancies greater than 20 mm can alter biomechanics and loading patterns with resultant functional limitations and musculoskeletal disorders, such as functional scoliosis. Long-standing LLD and functional scoliosis often result in permanent degenerative changes in the facet joints and intervertebral discs of the spine. Further understanding of the contribution of LLD in the development of scoliosis and degenerative spine disease will allow for more effective preventative treatment strategies and hasten return to function. Use of LLD for diagnosis of subluxation is not appropriate.

Mattatia et al. (2024) authored a manuscript on studies of leg-length discrepancies (LLD). A large number of studies have emerged, most frequently using assessment criteria based on painful symptoms or joint damage. While many authors argue for a threshold of 10-20 mm to establish a link between pain and LLD, most publications based on radiography show lesion stigmata on lumbar, hip and knee joints as early as 6 mm. This would be linked to comorbidities. Authors summarize that some studies argue forcefully that leg-length correction below 20 mm is of no benefit. The authors of the present article, on the other hand, evoke the notion of lesion risks in the absence of correction, even for small deviations in the presence of certain associated factors and according to their importance. The authors argue for the need to define in the future a lesion significance score that would not be correlated to painful symptomatology, but rather to the presence of co-morbidities such as age, anatomical variability, sports practice and/or patients' professional activities. Other parameters, such as mobility, should also be taken into consideration, while gender, height and weight do not appear to be significantly related.

Sugavanam et al. (2024) examined common static postural parameters between participants with and without low back pain (LBP) in a systematic review and meta-analysis. Studies included in review = 46 (5,097 LBP; 6,974 controls); meta-analysis = 36 (3,617 LBP; 4,323 controls). Quality of included studies was mixed. Pelvic tilt was statistically significantly higher in participants with LBP compared to controls. Lumbar lordosis and sacral slope may be lower in participants with LBP; pelvic incidence may be higher in this group; both were not statistically significant and the between study heterogeneity was high. Thoracic kyphosis and leg length discrepancy showed no difference between groups. Authors concluded that lumbopelvic parameters and especially pelvic tilt may be altered in people with low back pain, although no firm conclusion could be made due to the high heterogeneity between studies. Postural assessment within low back pain rehabilitation may therefore require an individualistic approach.

There are no safety concerns associated with the use of the procedure. There is the potential risk of substitution harm if LLI tests are used in place of physical/neurological examination techniques with demonstrated diagnostic utility.

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