Association of Mild Leg Length Discrepancy and Degenerative Changes in the Hip Joint and Lumbar Spine

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Abstract

Objective: The purpose of this study was to evaluate the correlation between mild leg length discrepancy (LLD) and degenerative joint disease (DJD) or osteoarthritis.

Methods: We evaluated standard postural lumbopelvic radiographs from 255 adults (121 women and 134 men) who had presented with spinal pain for chiropractic care. Symmetry of femoral head diameters was used to exclude magnification errors. Pearson's partial correlation was used to control for age and derive effect sizes for LLD on DJD in the hip and lower lumbar motion segments. Krippendorff's α was used for intraobserver and interobserver reliability.

Results: A strong correlation was found between LLD and hip DJD in men ($r = 0.532$) and women ($r = 0.246$). We also found a strong correlation between LLD and DJD at the L5-S1 motion segment in men ($r = 0.395$) and women ($r = 0.246$). At the L4-5 spinal level this correlation was much attenuated in men ($r = 0.229$) and women ($r = 0.166$).

Conclusions: These findings suggest an association between LLD and hip and lumbar DJD. Cause–effect relationships between mild LLD and DJD deserve to be properly evaluated in future longitudinal cohort studies. (J Manipulative Physiol Ther 2017;xx:0-10)

Key Indexing Terms: *Leg Length Inequality; Osteoarthritis, Hip; Osteoarthritis, Spine*

Introduction

Degenerative joint disease (DJD) or osteoarthritis, the most common form of arthritis, affects at least 15% of the general population and causes substantial disability and health care expenditure.[1] It commonly affects the hip joints and the lumbar spine. Prevalence of symptomatic hip DJD has been reported to be as high as 10%.[2] Prevalence of moderate to severe DJD of lumbar facet joints is even higher—it has recently been reported as 36% in adults younger than 45 years—and increases sharply with age.[3] In addition, the prevalence of degeneration of the lower lumbar intervertebral discs can be as high as 69% to 76% of the adult population.[4] Again, this prevalence increases sharply with age.[4] Degenerative joint disease is a multifactorial condition with many risk factors identified, including abnormal or excessive mechanical joint loading,[5] as occurs with lower extremity joints or spinal discs in obesity,[4-6] and excessive occupational standing or lifting.[7] Abnormal joint loading is also believed to play a major role in the development of adjacent segment degeneration after surgical fusion of a spinal motion segment.[8]

A common condition that involves abnormal loading of the lower extremity and lumbar joints is leg length discrepancy (LLD).[9] Leg length discrepancy, in which one femoral head is lower than the contralateral side in the standing position, can be due to differences in anatomic lengths of bones of the lower extremities (anatomic LLD), functional differences in the tone of lower extremity muscles from side to side, or abnormalities of joint function (functional LLD).[10] Approximately 59% of the population has an LLD of ≥5 mm.[9] However, 99.9% of LLD can be classified as mild because it is <20 mm.[9] The magnitude of LLD that reaches clinical significance[11-13] and its contribution to the development of DJD has not been

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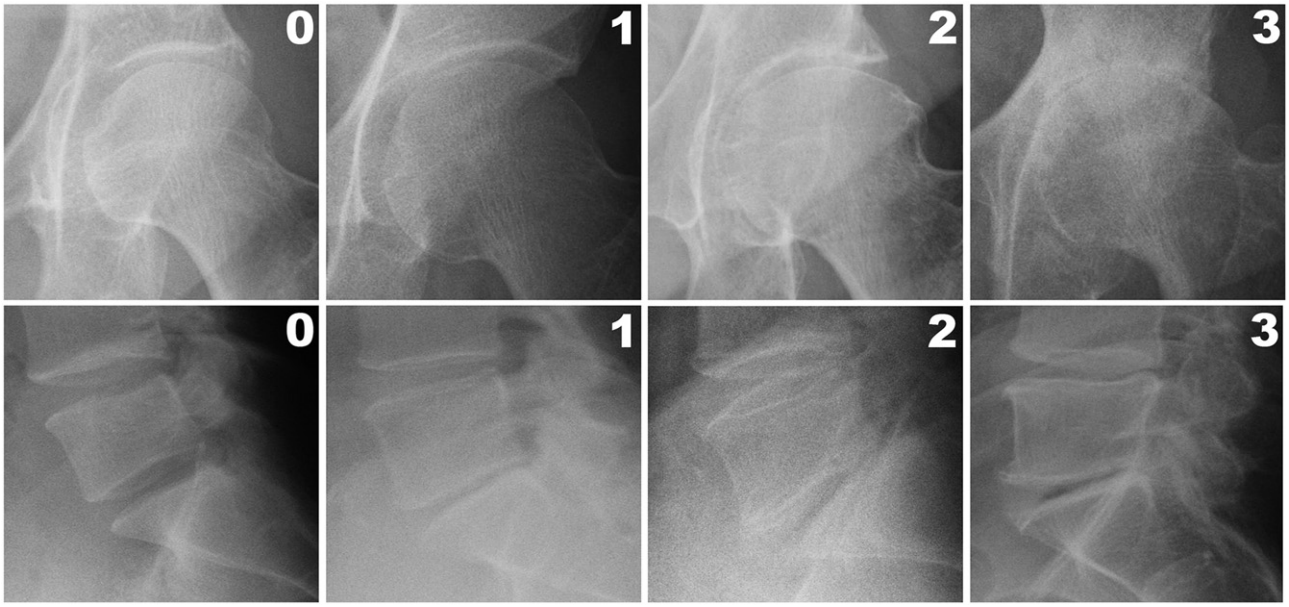

Fig 1. *Classification of degenerative joint disease (DJD). The severity of DJD in the hip joint and lower lumbar spine (L5-S1 displayed in this panel) was scored on a 4-point scale corresponding to: no DJD (0); mild DJD (1); moderate DJD (2); and severe DJD (3).*

rigorously characterized.[11-14] Most of the surgical literature has considered LLD of <20 mm clinically insignificant.[15,16] In addition, most studies of the association between LLD and hip or low back pain have examined a discrepancy of at least 20 mm.[17,18] However, a vast majority of these studies have relied on clinical measurements of leg length that are known to have large error margins.[18,19] The standard in quantifying differences in leg length (LLD) is a radiographic method, devised originally by Friberg[20] and with an error margin of <2 mm. Gofton[14] reported that this method can be used without compromising accuracy on standard anteroposterior lumbopelvic radiographic views. These accurate radiographic methods have made it possible to study mild LLD (<20 mm). As a result, mild LLD was reported to correlate with DJD of the knee.[21] Indeed, most of the LLD literature has focused on the knee and ankle, whereas the hip joint and particularly the lumbar spine have received scant research attention. This is important because knee or ankle DJD may result in LLD, whereas this is not the case with DJD of the lumbar spine or the hip in the absence of deformity of the femoral head. Leg length discrepancy-induced DJD is also important in the context of total hip arthroplasty–induced LLD and may be relevant in optimization of the success of total hip arthroplasty procedures.[22] Nevertheless, only the presence of a correlation between mild LLD and DJD of the hip or the lumbar spine would warrant investigation of the possibility of LLD contributing to etiology of DJD at these sites. Therefore, the purpose of this study was to assess correlation between mild LLD and DJD of the hip joint and the lower motion segments of the lumbar spine in a population of chiropractic patients presenting with spinal pain.

Materials and Methods

Selection of Radiographic Series

Digital standing lumbopelvic radiographic series (575 sets) from patients who presented to the RMIT University chiropractic clinics were assessed for this study. To avoid bias, no clinical data were sourced from patient files. These films were obtained using the standard chiropractic radiographic positioning protocol at RMIT University in which students ensured proper positioning of the patient, including ensuring that the patient was standing upright on flat ground without shoes, with knees extended and feet placed directly under the hip joints, and with the pelvis placed parallel to the film. Radiographic images that were not of diagnostic quality or that indicated signs of pathologic conditions that may have compromised the analysis were excluded. These conditions included degenerative deformity of femoral head, coxa magna deformity, advanced scoliosis, congenital or developmental abnormalities such as facet tropism and transitional lumbosacral vertebrae, evidence of spinal fusion or hip arthroplasty, and nondegenerative spondylolisthesis.

We made sure that the intergluteal line was midline on the anteroposterior (A-P) lumbopelvic view and that there