

A Study of Lower Extremity Length Inequality

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THESE AUTHORS NOTE:

In this study, the authors constructed a spinal fixation and stabilization device to ensure the accuracy of upright measurements of leg length and their effects on spinal alignment.

The 1,000 soldiers in this study were consecutive, non-selected cases who were sent to the roentgen (X-ray) department because of a low back complaint. By using their meticulous methodology of measurement, these authors conclude it is possible to accurately measure differences in lower extremity lengths as manifested by a difference in the heights of the femoral heads.

The greatest difference in leg length measured was 44 mm, or about 1.75 inches.

23% of the soldiers had legs of equal length.

77% of the soldiers had unequal length of their legs, as follows:

Equal Leg Lengths 23%
Short Leg 77%
5 mm Short Leg 39.5%
10 mm Short Leg 22.5%
21 mm Short Leg 13.3 %
More than 22 mm Short Leg 1.7%

The incidence of limb shortness was nearly equal between the left and right sides. The average shortening was slightly more than 7 mm.

Concerning spinal biomechanical function, these authors noted that the short leg was associated with a tilt of the pelvis and a scoliosis. The authors noted:

- 1) The roentgenograms were made in the upright position with the use of the stabilization device. Whenever there is a pelvic tilt, there exists coincidentally a scoliosis of the lumbar spine.
- 2) Because this scoliosis, in all instances, compensates for the tilt of the pelvis, it is referred to by us as compensatory scoliosis.
- 3) The existence of this compensatory scoliosis in the presence of a tilted pelvis due to shortening of one or the other lower extremity is believed by us to have clinical significance and, furthermore, it **is our opinion that the existence of any such condition cannot be determined with any degree of accuracy on gross physical examination. [Important]**
- 4) Furthermore, it becomes immediately apparent that the making of roentgenograms of the lumbosacral spine in the recumbent position, as is frequently done, completely prevents the discovery of such pathology as this.
- 5) It was a general consistent observation that the degree of scoliosis was proportionate to the

degree of pelvic tilt. An individual who has a shortened leg will have to compensate completely if he intends to hold the upper portion of his body erect or in the midsagittal plane.

6) A consistent observation which has been made is that in those cases with a shortened leg there is a corresponding tilt of the pelvis and a compensatory scoliosis of the lumbar spine.

Of the 770 observed short leg cases seen in this study, only 8 had non-compensatory scoliosis. These scoliosis deformities were associated with pathology such as bony changes from old trauma to the disc, facet, or vertebral body, and these authors defined them as structural scoliosis.

Leg length differences exceeding 5 mm were associated with greatest low back pain or disability, and therefore 5 mm is labeled as being a "marked difference." The authors stated: For this reason, it is our opinion that the existence of such a condition [a short leg exceeding 5 mm] is significant from the standpoint of symptomatology and disability.

Other findings noted in these 1,000 soldiers include:

Sacroiliac Joint Arthritis 5.5%
Increased Lumbosacral Angle Above 50° 4.3%
Lumbosacral Transitional Segment 3.7%
Pars Defect With Spondylolisthesis 2.7%
Reduced Lumbar Lordosis 2.5%
L5-S1 Facet Tropism 1.5%
Pars Defect But No Spondylolisthesis 1.0%
L5-S1 Retrolisthesis 0.6%

KEY POINTS:

1) Leg length differences as large as 44 mm, or about 1.75 inches can occur in patients presenting with back pain.

2) In 1,000 soldiers, this study found:

Equal Leg Lengths 23%
Short Leg 77%
5 mm Short Leg 39.5%
10 mm Short Leg 22.5%
21 mm Short Leg 13.3 %
More than 22 mm Short Leg 1.7%

3) The incidence of limb shortness is nearly equal between the left and right.

4) The average leg length difference is slightly more than 7 mm.

5) The short leg is associated with a tilt of the pelvis and a scoliosis.

6) **X-rays made in the upright position document** that whenever there is a pelvic tilt, there exists coincidentally a scoliosis of the lumbar spine. Because this scoliosis, in all instances, compensates for the tilt of the pelvis, it is referred to by us as compensatory scoliosis.

7) The existence of this compensatory scoliosis in the presence of a tilted pelvis due to shortening of one or the other lower extremity is believed by us to have clinical significance and, furthermore, it **is our opinion that the existence of any such condition cannot be determined with any degree of accuracy on gross physical**

examination. [Important]

8) Roentgenograms of the lumbosacral spine in the recumbent position, as is frequently done, completely prevents the discovery of such pathology as this.

9) It was a general consistent observation that the degree of scoliosis was proportionate to the degree of pelvic tilt. An individual who has a shortened leg will have to compensate completely if he intends to hold his upper body erect.

10) Of the 770 observed short leg cases seen in this study, only 8 had non-compensatory scoliosis. These scoliosis deformities were associated with pathology such as bony changes from old trauma to the disc, facet, or vertebral body, and these authors defined them as structural scoliosis.

11) **Leg length differences exceeding 5 mm were associated with greatest low back pain or disability, and therefore 5 mm is labeled as being a "marked difference." The authors stated: For this reason, it is our opinion that the existence of such a condition [a short leg exceeding 5 mm] is significant from the standpoint of symptomatology and disability.**
