



## What is Leg Length Discrepancy?

A leg length discrepancy (LLD) exists when one leg is longer than the other with respect to the same individual. Such discrepancies are relatively common, occurring in up to 70% of the general population (1).

LLD may be classified as a structural or functional discrepancy, depending on the source. It is important to differentiate between the two types of LLD as their treatments differ greatly.

Structural discrepancies occur when one or both bones in the leg (the femur and/or the tibia) physically measures longer than the bone(s) on the opposite side. This type of discrepancy may be congenital or can result from trauma, surgery, or degenerative disease.

Functional discrepancies exist when the bones are the same length but a muscular or alignment issue results in the appearance and symptoms of a true LLD. Such a case may arise from the following, among other functional issues:

- Muscles surrounding the hip joint are tight, resulting in a hip elevation on one side
- Scoliosis of the spine
- Asymmetrical foot movements (pronation)

## What do people experience?

Symptoms vary from person to person and depend upon the type, amount, and source of the discrepancy:

- Lower back pain
- Possible hip, knee, or foot pain
- Limp or poor balance while walking
- Feeling of a constant lean to one side
- Tiring easily from long periods of walking or activity
- Frequent lower back and/ or limb injuries with no apparent cause
- Discomfort bending over or standing for long periods of time

## Risk factors & how to avoid discomfort

Risk factors for discomfort include:

- Heavy lifting
- Activities that require bending, twisting, or reaching
- Poor fitting or worn out footwear
- High impact and high volume or intensity of exercise during periods of heightened symptoms
- Being overweight or obese may increase the strain on the joints and muscles in your lower back
- Stress and anxiety can play a role in heightening symptoms
- Improper lift height for structural LLD
- Using a shoe or foot lift when your LLD is actually functional
- Switching between periods of lift use and no lift use

## What are my options for treatment? Who else can help?

Depending on the source and type of LLD, treatment options vary. If your healthcare provider or primary care physician suspects a structural discrepancy but is unsure, a scanogram x-ray is one of the best ways to determine presence and amount of discrepancy. This type of x-ray superimposes a ruler directly onto the image in order to measure the bones and joint spaces in your lower extremities allowing the radiologist to compare sides. There is still a chance for measurement error with this method but it is commonly quite accurate.

## Functional

Treatment of functional discrepancies resulting from muscular tightness or imbalance typically involves stretching and strengthening provided by a physiotherapist and/or massage therapist. Functional discrepancies resulting from alignment issues, such as asymmetrical foot movements, can be remedied with custom or off-the-shelf foot orthotics provided by a pedorthist, podiatrist, chiropractor, or orthotist. Functional discrepancies resulting from scoliosis may be treated with custom foot orthotics from one of the above foot care professionals, with other lower extremity or back orthotics (braces) from an orthotist, or a stretching and strengthening routine provided by a physiotherapist. For some individuals, whether it is a structural or functional discrepancy, chiropractors can be helpful with alignment issues.

## Structural

True structural discrepancies are typically addressed using full foot lifts for the short side. Depending on the amount required, the lift can either be applied within the shoe underneath the footbed or orthotic, or directly to the midsole of the shoe. Assuming the shoe has adequate depth and volume, lifts up to approximately 1cm can be placed within the shoe. This type of lift is nice because it doesn't add much weight to the shoe and is completely hidden within the shoe underneath an orthotic or insole. When lifts exceed 1 cm, they are more typically applied to the midsole of the shoe. If this is the case, the midsole of the shoe is split, the lift is added and the outsole is reapplied to sandwich the lift into the midsole of the shoe. This type of lift can be performed by a Canadian Certified Pedorthist and is tailored to the design of the shoe in order to provide esthetic appeal.

## Lift height

As mentioned above, one of the best ways to take a true measurement of a structural LLD is using a scanogram x-ray. This will take a definitive measure of the bones in your lower extremity and serve as a solid starting point for lift height. In-clinic tape measurement methods are also commonly used to determine a starting point for lift height. The amount of lift to be applied is determined by a number of factors. If the discrepancy is the result of a surgery, such as a knee or hip replacement, in many cases the full amount of discrepancy can be accommodated for by the lift. This means that if your left leg is 1 cm longer than your right following the surgery, we can often provide the full 1 cm of lift to the right leg, and it is quite comfortable. When the discrepancy is congenital (from birth) and not caught until later in life, providing a lift for

the full amount of discrepancy is usually not well tolerated. The body will make adjustments to naturally accommodate for the discrepancy, which seems to make a full lift intolerable. When this is the case, we typically start with 60-70% of the discrepancy and go up or down depending on how things look and feel at follow up.

## **Staying active with pain**

Daily discomfort can be managed and in many cases improved with moderate intensity, low-impact exercise. During times of heightened symptoms, low intensity range of motion exercises and stretches may help relieve muscular tightness. High impact and intensity exercise should be avoided until symptoms are fully under control or until your physiotherapist or kinesiologist suggests it is ok for you to do so. An appropriate warm up and cool down should always be performed before and after exercise to ensure optimal muscle function. If you are new to exercise or have questions regarding appropriate exercise selection, consult with your kinesiologist or physiotherapist.

Appropriate footwear with adequate support and cushion is important during periods of exercise. In cases of LLD, it is imperative that you wear supportive footwear with your appropriate lift height. Consult with your pedorthist regarding footwear that is appropriate for your foot type and selected activities. If your lift height has not yet been determined, or if you are currently working to resolve your symptoms, exercise programs should be undertaken with caution and qualified guidance.

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## **SORE BACK? IT COULD BE YOUR FEET!**

To feel better, read on!

### **How can SoleScience help you feel better?**

Gait and movement testing:

- Clinical tape measurement of leg length
- Referral for X-ray, Scannogram
- Static alignment
- Movement testing
- 2D Gait analysis etc.

The pedorthists at SoleScience will work with you to get you feeling better immediately following your first visit. While you are waiting for your custom foot orthoses to be manufactured (typically three to five days), your pedorthist will work with you to improve comfort, both in and out of the house. Whether you know it or not, both the shoes and activities that you select may be your best friend or your worst enemy! If your discrepancy is structural, an off-the-shelf lift can often be provided for use within your shoe while you wait for your lift, custom foot orthoses, or shoe modification to be completed.

## **Our take on the need for custom foot orthoses**

The symptoms associated with LLD vary greatly, and in many cases, can be treated successfully with custom foot orthoses. Custom foot orthoses can be used to accommodate for structural discrepancy, control asymmetrical foot movements resulting from structural or functional discrepancies, and to address concerns relating to secondary or compensation injuries. When LLD is present, whether structural or functional, the body compensates to accommodate. Compensations can result in greater pressure or forces being placed on other areas of the body, which may result in injury or discomfort in feet, knees, hips, and lower back. Sometimes, it is these secondary or compensation injuries that actually bring the LLD to light. Through proper communication between your primary care physician and qualified foot care professional, custom foot orthoses may be the solution that you have been looking for.

## **Custom vs. OTS**

OTS or off-the-shelf orthotics are pre-fabricated devices that can be fit in to your shoes right from the shelf. This type of orthotic is typically heat moldable, allowing for a degree of immediate customization. Truly custom-made foot orthoses are differentiated in that they are designed specifically around a 3D model of your foot. This type of orthotic can be completely tailored to suit your needs. Depending on your symptoms and mechanics, OTS devices may be a great first step and can be adjusted to work with a foot lift, (if it's determined that you have a structural LLD). In cases where the support and cushion offered by the OTS device is enough to address the concern, it may be as far as you need to go. If the OTS device provides some relief but doesn't quite offer enough support, or if it does not match well to your foot type, custom may provide the most comfort and relief of symptoms.

## Footwear recommendations

Appropriate footwear selection is important for day-to-day comfort and depends on your specific mechanics. Generally speaking, footwear with ample cushion and support work well while managing your symptoms. No matter which shoe you select, proper fit is vital. Length, width, depth, and heel height are important considerations to make. If you are hoping to conceal a lift for your structural LLD within the shoe, depth may be the determining factor. Ensure the shoes you select have a removable insole with decent thickness and that the shoe is not too tight on your foot. Consult with your pedorthist for recommendations specific to your foot type and intended use. If you have a structural LLD, your pedorthist will work with you to determine the amount of lift you require and whether the lift can be concealed within the shoe or applied directly to the midsole of the shoe.