

# Starting Strength

## Leg Length Discrepancy: The Use of a Shim

by

Mark Rippetoe

A surprisingly large percentage of the population has a Leg Length Discrepancy (LLD) – I’ve seen estimates, probably conservative, that 70% of the population exhibit LLD. It’s normally not noticeable when the difference is less than ½ inch (13 mm) or so. But when it’s greater than that, the asymmetric loading on the pelvis under a squat or deadlift can be enough to cause problems that should be addressed with corrective measures. We use a shim under the foot.

When there is a way to accurately measure leg length – and this is difficult when the discrepancy is small – perfectly symmetrical leg length becomes quite rare. Perfectly symmetrical *anything* is quite rare, because the processes that generate physical objects in our end of the universe are not uniform much above the molecular level. Crystals, planets, holes, mountains, plants, animals, and everything else in Nature exhibits some degree of asymmetry *if you look closely enough*. Manufacturing processes are designed to fight this tendency, and sometimes they’re even successful if you spend enough money.

Damn near everybody has one leg at least a little tiny bit shorter than the other. Less than 5 mm (0.2 in) is hard to see and usually needs no correction. I have been looking at these things for a long time, and I can see a 10 mm (0.4 in) LLD under the bar, although the trainee may not feel the asymmetry and it may be causing no problems. In contrast, I have a member here with a 3 cm (1.2 in) discrepancy, a quite noticeable and definitely a necessary-to-correct difference.

When a LLD causes problems, they usually take the form of low back pain, hip pain, or sometimes knee pain. The basic problem here is a non-level pelvis, which results in a lateral asymmetry in lumbar spinal loading. Intervertebral discs are designed to be asymmetrically “wedged” front to back in their normal lordotic curve, even while they are designed to be loaded symmetrically side-to-side. If the legs are of different lengths, they have not cooperated in this endeavor.

A lateral curve in the lumbar spine smashes the discs closed on the concave side of the curve and pulls them open on the convex side. The lower back and pelvic muscles, ligaments, and discs adapt to the short leg by adjusting to this asymmetrical position in various ways, a persistent condition sometimes referred to in The Trades as a “functional leg length discrepancy,” which is really the direct result of an anatomically short leg.

In some cases a “functional” discrepancy can be produced in the absence of an anatomically short leg by a condition such as a flat foot, a collapsed arch, or the loss of plantar supination on one

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side. This can produce an internally rotated tibia, a valgus knee, and an internally rotated femur on that side, in net effect “shortening” the leg. This situation is easily addressed with an arch support and some decent squat shoes, which immediately corrects the foot situation, and the postural correction provided by squats themselves, which strengthen the external rotators responsible for maintenance of normal anatomical position.

But all too often in some therapeutic disciplines, a “functional LLD” is the diagnosis when a real live anatomically-short leg is the problem. The “functional” problem gets preferentially treated with silly “corrective exercises” before the actual cause of the problem – the short leg – is addressed. In these cases, the “functional LLD” diagnosis implies that there really isn’t a “leg length discrepancy” per se, when there obviously is if you measure it correctly. Since the “functional” aspects of the asymmetry are the direct result of the anatomically short leg bones, the situation must be addressed by correcting the length of the short leg.

Making the legs the same length restores the pelvis to a symmetrical position in the horizontal plane, and therefore restores lateral symmetry to the lumbar spine and any load it bears. Any residual asymmetries in any other plane usually correct themselves after the leg length difference has been corrected, the degree of correction depending on the length of time the discrepancy has been present (the age of the individual) and the severity of the uncorrected discrepancy.

Barbell training expedites this process if perfect symmetrical technique is enforced after the correction of the LLD, since symmetrical execution of a bilateral loaded movement pattern requires that all the components of the kinetic chain do their anatomically-proportionate share of the work. The weak parts get stronger because they have to, and the excessively-hypertrophied parts get a little break now that their buddies are doing their job.

To be clear: in the absence of a measurably significant discrepancy in the anatomical length of the femur and tibia, the problem is corrected with the enforcement of proper technique under the bar – not a shim under the foot. If your right knee caves in when you squat, lighten the weight until you can squat it with correct technique, and gradually go up from there. Remember: we deal with lifters, not the sedentary public. A “functional LLD” is therefore a movement pattern problem – perhaps a serious and persistent movement pattern problem, but a problem that can and should be corrected by coaching, not appliances. But when an anatomical LLD is present, you *must* shim the short leg.

People vary in their ability to tolerate a short leg – some backs hurt with a 5 mm (0.2 in), while other people remain pain free with a 10 mm (0.4 in). In general, the less loading the system receives, the greater the likelihood that the LLD is not a problem. A sedentary person may have a lifelong uncorrected ¾ inch (19 mm) LLD they don’t even know about, while a manual labor job or barbell training will eventually produce chronic back pain for a person with any significant uncorrected LLD.

Which means that barbell training will aggravate an otherwise asymptomatic LLD. If you have a LLD and you’re planning on getting strong with barbell training, it will need to be addressed if it is significant. If you have started barbell training and you are experiencing chronic low back pain, make sure your form is correct, then make sure you are sleeping on a good mattress, and then think about a leg length discrepancy.

At every seminar we identify at least one or two people with a LLD that needs correction. Most of these people don’t know they have the problem, although when questioned almost all of them will report back pain of varying severity, all of them having been squatting and pulling prior to coming to the seminar. We shim the short leg, the first shimmed set feels funny, and then the subsequent sets feel better as a result of this chronic problem being addressed for the first time.

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This girl shows a typical short leg presentation. Note the subtle difference in the angles of the legs measured from vertical. The more significant the discrepancy, the more apparent the difference in leg angle will be. If I see an asymmetry this obvious I will generally lay the trainee on the floor, or the exam table if one is available, and further examine the LLD with the seat-of-the-pants Strength Coach method I have distilled from consultations with PTs, DOs, and years of personal experience.



*Figure 1.*

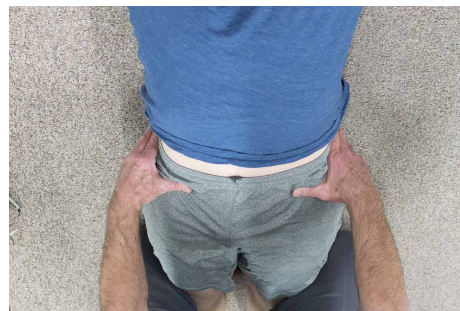
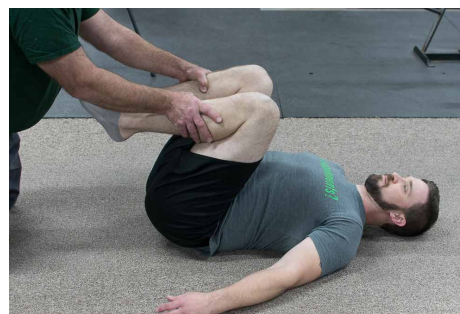
I start by laying the trainee down on his back on the floor, either parallel or perpendicular to any visible lines or patterns on the floor – non-right angles can interfere with the visual observations made later. Although many practitioners examine the pelvis from the posterior, I have found it easier to see the relevant pelvic landmarks from the front. Next, from a kneeling position at his feet, I grip the lower shins and push the knees and hips back into full flexion, with the spine in flexion as well, hips clear of the floor. I'll hold him in this position for a few seconds, then rotate his knees side to side, to relax tension in the low back. Then I'll lower his legs straight back down to the floor, after instructing him to let me do the lowering – I don't want him to tighten up after I have relaxed his back.

Then I place my thumbs on the inferior sides of both ASIS (the hip pointers), making sure each thumb is in the same place relative to the bone on each side. These should be level as I observe them from above, both in the horizontal and frontal planes. If they are not level, I level them by pulling the high side's leg downward and working the pelvis until everything is square. If the pelvis is level, any leg length discrepancy below the hips is visible at the knees and ankles.

Then I move down to the knees and place my thumbs on the superior surface of the patellas. I do not do this visually, but rather by feeling the landmarks with my hands and making sure each side feels like it's in the same place. I don't want to bias my analysis by seeing what I want to see. After my thumbs feel like they are in the same place on each side, I'll visually check them for level. Level hips and non-level patellas usually mean a short femur.

It has been my experience that most LLDs are tibial, with femoral length discrepancies being far less common and more complicated to manage. If we shim the short leg in the case of a short femur, the knee on the shimmed side will be even higher despite the fact that the pelvis is now level. This will mean that a level pelvis will come at the expense of uneven knees during the squat and deadlift.

### *Assessment from pelvis to knee*



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A short femur with the pelvis restored to level by a shim under the foot will result in that knee being behind the other knee in the frontal plane, seen from the top. If the shin/ankle angles are to be the same on each side, the shimmed foot will need a staggered stance adjustment – the toe of the short side will be behind the other toe a distance that is the same as the femur discrepancy. This keeps the shim from screwing up the pelvic symmetry we are trying to restore.

If the patellas are level, I'll move down to the medial malleolus, the bony prominence on the inside of the ankle. I'll then visually inspect these landmarks for level before checking the heels (this exam is always performed without shoes). Usually I will see non-level heels in a person I have identified as asymmetrical under the bar.

The rough estimate of this heel-level discrepancy is where I start with the shim's dimensions. I keep some scraps of rubber floor mat of different thicknesses around for this purpose, and I'll stack rubber on the platform on the short leg side to match the difference in heel height I observe in the exam. If the LLD is huge, I'll gradually add to the shim over two or three sets rather than trying to correct the whole thing at once – that's too big a shock to the lifter's technique, and an incremental adjustment in height feels less weird. Then after a couple of sets I check the shimmed stance for leg-angle symmetry using the same observation position used to identify the problem.

For some people, the shim must be adjusted over a few workouts until a balance between completely level hips and shim height is achieved. At this point, the shoe should be shimmed. Take your lifting shoes to a shoe repair shop and have the short side shimmed to the thickness necessary. The whole shoe sole's thickness should be uniformly adjusted with a piece of dense rubber, and then the soles replaced on both shoes for compositional uniformity against the floor. I prefer a neoprene sole because it lasts a very long time, it never gets slick with age or oxidation, and it remains tacky against all flooring materials – wood, rubber, or concrete. Crepe tends to harden over time, losing its traction.

Under no circumstances should you let anybody talk you into a heel lift *only*. This obviously produces an ankle-angle asymmetry, and is patently foolish since we are, after all, lifting heavy weights, *and asymmetry is what we're trying to correct*. If the LLD is significant enough to shim, it is significant enough to be a problem if the correction produces different amounts of plantar flexion. Just shim the whole shoe and address the whole problem.

### *Assessment from knee to sole*



*A shimmed left shoe*

## *Leg Length Discrepancy*

Leg Length Discrepancy is common, and should be addressed as soon as it's identified. It is possible to do this without the services of a Physical Therapist, a Chiropractor, any other medical professional, or their X-ray machines by using the simple method outlined here. If you make careful observations and verify your adjustments, there should be no problems, but if there are, kick it upstairs if you're confident that you know a competent practitioner. Don't be one of the people who refuse to refer out when you're in over your head.

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