

Conservative Correction of Leg-Length Discrepancies of 10 mm or Less for the Relief of Chronic Low Back Pain

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Ruth Defrin PhD, Sarit Ben Benyamin MSc, R. Dov Aldubi PhD, Chaim G. Pick PhD

FROM ABSTRACT

Objective: To study whether conservative correction in a leg-length discrepancy (LLD) of 10 mm or less in patients with chronic low back pain (CLBP) can relieve pain.

Design: Randomized, controlled intervention study, with a mean follow-up duration of 10 weeks.

Participants: Thirty-three patients with CLBP were screened for an LLD of 10 mm or less, which was measured with ultrasound. Patients were randomly divided into intervention and control groups.

Intervention: In 22 patients, LLD was corrected by applying individually fitted shoe inserts. In 11 patients, LLD was not corrected.

Main Outcome Measures: Chronic pain intensity (visual analog scale) [VAS] and disability score (Roland-Morris Disability Questionnaire) [RMDQ].

Results: Shoe inserts significantly reduced both pain intensity and disability.

A moderate positive correlation was found between LLD and the degree of pain relief after wearing shoe inserts.

Conclusions: Shoe inserts appear to reduce CLBP and functional disability in patients with LLDs of 10 mm or less.

Shoe inserts are simple, noninvasive, and inexpensive therapeutic means that can be added to the treatment of CLBP.

THESE AUTHORS ALSO NOTE:

“Low back pain affects 80% of adults during their lifetime and is the chief medical condition that causes disability and in which health care dollars are spent.”

Known causes of LBP include:

Degenerative disease of the spine and hips Nerve injury

Referred visceral pain Musculoskeletal disorders

Lower-extremity joint disease Soft-tissue pathology

“Several researchers have suggested that leg-length discrepancy (LLD)—that is, a disparity of length between the legs—might also be a cause of LBP.”

[Important]

“It is suggested that LLD causes asymmetry in the lower-extremity joints and in the spine and pelvis, leading to stress and strain with a derangement of normal biomechanical function and functional alterations.”

A common alteration is “pelvic obliquity that can be associated with postural or structural scoliosis, which increases the working load exerted on different structures in the back region (eg, muscles, ligaments, joint capsule) and on joints and disks.” “This may lead to modifications in the lumbar spine (eg, asymmetric facet joint angles, facet arthrosis, traction spurs, disk compression) that in turn may lead to chronic LBP (CLBP).”

Most researchers agree that an LLD of more than 20 mm can cause LBP.
[25 mm = 1 inch]

Several researchers [5 references] have suggested that a “discrepancy of 10 mm or less can cause arthritic changes in the lumbar spine and LBP.”

A LLD of 9 mm induces a change in the angle of the lumbar facet joints.

A LLD of 6 mm causes pelvic tilt and scoliosis.

A LLD as small as 3 mm will induce postural changes.

“The common conservative correction of LLD is to apply a heel lift to the shorter leg.”

A heel lift applied to patients with an LLD of **more** than 10 mm reduced their LBP and increased their range of motion of the lumbar spine. [4 references]
In one study, researchers could significantly reduce CLBP in professional dancers with heel lifts when their LLD was as small as 2 mm.

Mild LLD can lead to low back pain. [7 references]

Mild LLD is common, being found in as many as 96% of the adult population.

Yet, the correction of an LLD of 10 mm or less is usually not incorporated in the treatment of LBP.

“The uniqueness of this study is that the LLD was corrected with shoe inserts, as opposed to heel lifts, to prevent unnecessary shortening of the Achilles’ tendon, as may occur when wearing the latter.” **[Important]**

In this study, LLD was measured ultrasonographically and not with clinical methods.

This study used 17 men with CLBP of at least 6 months duration, and an average age of 44 years, all with LLD of 10 mm or less. Interestingly only 1 of the 33 patients they initially screened for this study had LLD of greater than 10 mm. “The patients selected did not receive any intervention during the study other than LLD correction.”

The LLD measurements were done with ultrasonography of the femur head while each subject was standing upright and barefoot, and then measuring the distance from the femur head to the floor. The LLD was then calculated by subtracting the “shorter” leg distance from the “longer” one.

These authors note that x-ray determination of LLD is the most accurate, but prove that ultrasonographic is also quite accurate and does not involve radiation.

All patients had multiple assessments, including the visual analogue scale (VAS) and the Roland-Morris Disability Questionnaire (RMDQ), which yields "reliable measurements that are valid for inferring the level of disability and to be sensitive to change over time for groups of patients with LBP."

The shoe insert used was made of an elastic smooth plastic material of 2 mm thickness and put inside the shoe of the shorter leg. Additional elevations of 2 mm were added every 2 days until the desirable height was achieved.

Patients were then asked to wear the shoe insert all day long for at least 12 weeks.

VAS scores decreased significantly after wearing the shoe lift, whereas those of the control group did not change significantly.

Patients with larger LLDs had larger reductions in pain intensity after wearing the shoe insert.

Patients with longer duration of LBP had larger reductions in pain intensity after wearing the shoe insert.

DISCUSSION

Shoe inserts applied for several weeks significantly reduced both LBP intensity (VAS scores) and disability scores (RMDQ)."

Because "patients did not return for additional treatment after the LLD correction, although such was offered to them, suggests that the LLD correction had an important effect on their lives."

Most patients continued wearing their shoe lift "even after the study was terminated, indicating relatively good patient compliance and contentment." Patients reported that the shoe insert was comfortable and did not interfere with their activities of daily living.

"Patients of the control group who did not receive shoe inserts did not have any changes in either LBP intensity or disability scores." **[Important]**

The results of this study agreed with those of at least 5 other studies cited that found a significant reduction of LBP after mild LLD correction with heel lifts.

This study corrected the LLD with a shoe insert and not a heel lift. The advantage of applying a shoe insert to the entire foot instead of a heel lift is to prevent unnecessary shortening of the Achilles' tendon and changes in the lumbar lordosis that may occur when wearing a heel lift.

“Shoe inserts are a noninvasive, inexpensive, and readily available therapeutic measure.”

“Shoe inserts appear to be a possible treatment for LBP for patients who have an LLD of 10 mm or less.”

“Perhaps the best indication for the effectiveness of the shoe insert for LBP is the fact that in the following year after the termination of the study, patients of the study group did not return to receive alternative treatment, although such was offered to them.”

“It is possible that mild LLD is rarely treated because clinicians are not aware of the potential for its correction.”

“We hope that the results of this study will encourage clinicians to measure leg length in patients with LBP and, if LLD is identified, to correct it with a shoe insert.”

Patients with mild LLD have been shown to have abnormal x-ray findings compared with controls, including wedging of the lumbar vertebrae, concavities of the lumbar vertebral endplates, osteophytes of the vertebral bodies, and scoliosis.

Most patients with herniated disks have a LLD of at least 5 mm, and their pain projects to the shorter leg.

The prevalence of LBP among patients with mild LLD is significantly higher compared with those without LLD. [Important]

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Leg Length Difference affects the lumbar spine in the following ways:

- 1) Causes pelvic obliquity with or without associated lumbar scoliosis.
- 2) Causes sacroiliac malalignment [subluxation].
- 3) Causes a compensatory asymmetry in the work performed by the muscles and ligaments that stabilize the low back.
- 4) Causes uneven forces in the sacroiliac joints.
- 5) Causes pathologic changes in the lumbar and sacral spine and in soft tissues.
- 6) “The asymmetry leads to facet arthrosis, lumbar endplate concavity, wedging of the L5 vertebra, lateral disk compression, and other changes, all of which may lead to LBP.”

Shoe insert to the shorter leg can potentially correct these problems.

In this study, 5/22 [23%] patients had complete pain relief, and 16/22 [73%] patients had substantial pain reduction. [This is a great result in 96%]

Only 1/22 [4%] patient did not have pain relief with shoe lift insertion.

In this study, there was no correlation between the degree of LLD and the intensity of LBP. [Important]

The major effect of the shoe insert starts soon after the beginning of its application.

Ultrasound measurement of leg length is a safe, accurate, and reproducible. The accuracy of the ultrasound measurement can be ± 2 mm.

X-ray measurement of leg length is also accurate and reproducible.

"The more clinical methods of simply measuring the distance between fixed bony landmarks with a tape measure or using blocks under the short leg and visually examining the pelvis level have many possible sources of error, including unilateral deviation in the long axis of the limb, difficulties in palpating the anterior superior iliac spine, pelvic obliquity, and contractures. Consequently, these methods exhibit low accuracy, reliability, and validity."

"Clinical methods are not suitable for the identification of an LLD of 10 mm or less."(measuring without xrays)

CONCLUSIONS

"Correction of an LLD of 10 mm or less can significantly reduce CLBP."

"Shoe inserts are simple, inexpensive, and noninvasive means for alleviating CLBP and are therefore recommended to be included in the treatment of patients with LBP who have mild LLD."

KEY POINTS

- 1) "Low back pain affects 80% of adults during their lifetime and is the chief medical condition that causes disability and in which health care dollars are spent."
- 2) Leg-length discrepancy (a disparity of length between the legs) is a cause of chronic low back pain.
- 3) Mild leg-length discrepancy of 10 mm or less is common, found in 96% of the adult population.
- 4) Leg-length discrepancy as small as 2 mm can be clinically significant.
- 5) Shoe inserts significantly reduced both pain intensity and disability in patients with chronic low back pain and a short leg of 10 mm or less.
- 6) Leg-length discrepancy causes asymmetry in the lower-extremity joints and in the spine and pelvis, leading to stress and strain with a derangement of normal biomechanical function, postural scoliosis, stress on facet joints and discs, resulting in degenerative changes.
- 7) Shoe inserts reduce the stress on the Achilles' tendon as opposed to heel lifts.
- 8) These researchers initially inserted a 2 mm shoe lift, and increased the height by 2 additional mm every other day until the desired height was obtained.

9) "Patients of the control group who did not receive shoe inserts did not have any changes in either LBP intensity or disability scores." **[Important]**

10) Most patients with herniated disks have a leg-length discrepancy of at least 5 mm.

11) The prevalence of LBP among patients with mild leg-length discrepancy is significantly higher compared with those without leg-length discrepancy.

12) In this study, 96% of those treated with a shoe insert for chronic low back pain achieved complete pain resolution or significant pain resolution within 12 weeks.

13) Clinical methods of measuring leg length with a tape measure have low accuracy, reliability, and validity, and therefore are not suitable.

14) Shoe inserts are recommended to be included in the treatment of patients with chronic low back pain when they have mild leg-length discrepancy.