

## ORIGINAL ARTICLE

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

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**ABSTRACT.** Defrin R, Ben Benyamin S, Aldubi RD, Pick CG. Conservative correction of leg-length discrepancies of 10mm or less for the relief of chronic low back pain. *Arch Phys Med Rehabil* 2005;86:2075-80.

**Objective:** To study whether conservative correction in a leg-length discrepancy (LLD) of 10mm 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.

**Setting:** Physical therapy clinic of the national health services.

**Participants:** Thirty-three patients with CLBP were screened for an LLD of 10mm 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) and disability score (Roland-Morris Disability Questionnaire).

**Results:** Shoe inserts significantly reduced both pain intensity ( $P < .001$ ) and disability ( $P < .05$ ). A moderate positive correlation was found between LLD and the degree of pain relief after wearing shoe inserts ( $r = .47$ ).

**Conclusions:** Shoe inserts appear to reduce CLBP and functional disability in patients with LLDs of 10mm or less. Shoe inserts are simple, noninvasive, and inexpensive therapeutic means that can be added to the treatment of CLBP.

**Key Words:** Low back pain; Leg-length inequality; Rehabilitation; Ultrasonography.

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**L**OW BACK PAIN (LBP) AFFECTS 80% of adults during their lifetime and is the chief medical condition that causes disability and in which health care dollars are spent.<sup>1,2</sup> The causes of LBP include, but are not limited to, degenerative disease of the spine and hips, nerve injury, referred visceral pain, musculoskeletal disorders, lower-extremity joint disease, and soft-tissue pathology.<sup>3</sup> Several researchers<sup>4-7</sup> have suggested that leg-length discrepancy (LLD)—that is, a disparity of length between the legs—might also be a cause of LBP.

The exact mechanism by which LLD causes or augments LBP is not clear. 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.<sup>4-11</sup> A common alteration is, for example, 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.<sup>5,12,13</sup> 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).<sup>11</sup>

The minimal LLD necessary to cause LBP has been a matter of debate. Most researchers<sup>14-16</sup> agree that an LLD of more than 20 to 30mm can cause LBP. However, they disagree over the effect of an LLD less than 10mm. Several researchers<sup>4-6,17,18</sup> have suggested that a discrepancy of 10mm or less can cause arthritic changes in the lumbar spine and LBP. An LLD of 9mm was said to induce a change in the angle of the lumbar facet joints.<sup>4,17</sup> An LLD of 6mm was said to cause pelvic tilt<sup>9</sup> and scoliosis or altered lordosis.<sup>19</sup> An LLD as small as 3mm was found to induce postural changes.<sup>14</sup> Other researchers claim that only an LLD of more than 20mm is associated with LBP.<sup>20,21</sup>

Therapeutic options for the correct LLD range from no treatment to surgical shortening or lengthening procedures, depending on the degree of LLD.<sup>10,22</sup> 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 10mm reduced their LBP and increased their range of motion of the lumbar spine.<sup>4-6,20</sup> To the best of our knowledge, in only 1 study was the correction of an LLD of 10mm or less evaluated. Irvin<sup>23</sup> applied heel lifts to professional dancers with as much as 2mm of LLD and found that the heel lift significantly reduced their CLBP. No other studies on patients with LBP and an LLD of 10mm or less are available.

The need to study the effect of LLD correction on LBP patients with an LLD of 10mm or less is important for several reasons: (1) mild LLD can lead to LBP,<sup>4-6,9,17-19</sup> (2) mild LLD is common in as many as 96% of the adult population<sup>11,15</sup> and is significantly more common than larger LLDs,<sup>14,15</sup> and (3) the correction of an LLD of 10mm or less is usually not incorporated in the treatment of LBP.<sup>11,15</sup> 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.<sup>24,25</sup> Second, LLD was measured ultrasonographically and not with clinical methods, in which 10mm is within the error of measurement.<sup>15,26</sup>

## METHODS

### Participants

Thirty-three patients with LBP (17 men, 15 women; mean age  $\pm$  standard deviation [SD], 44.5  $\pm$  11.2y) participated. All had an asserted diagnosis of CLBP of a minimal duration of 6 months. The patients were recruited from an outpatient phys-

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ical therapy clinic. All patients were referred to the clinic by their physicians for the treatment of LBP. On arrival, they were approached by the investigator and offered participation in the study, and they received a full explanation regarding the aims and protocol. Investigators assured participants that they could withdraw from the study at any time and that refusal to participate in the study would not offend them in any way. In addition, participants were informed that they would be entitled to receive other treatment immediately at the end of the study. Only patients with an LLD of 10mm or less were included. (It should be pointed out that only 1 patient in 33 screened for inclusion in the study had an LLD greater than 10mm.) The patients selected did not receive any intervention during the study other than LLD correction. Patients underwent a full medical examination during screening, and those with LBP due to disk problems, nerve root, or major osteoarthritic changes in the vertebral column were excluded. Also, patients with acute LBP, pain or disability of the lower limbs of any kind (eg, ankle sprain, knee instability), systemic illnesses, or chronic pain of any kind except for LBP were excluded from the study. In addition, patients who had undergone an operation up to 6 months before the study or who had undergone multiple traumas (eg, road collision) were not included. All patients signed an informed consent in which the purpose and protocol of the study were explained. They were also asked not to change their habits or activities of daily living (ADLs) as much as possible throughout the study period and not to engage in any new treatment. The human rights committee of Tel-Aviv University and the local institutional review board approved the study.

### LLD Measurements

For each subject the length of the legs was measured before the experiment with ultrasonography.<sup>4</sup> The method of measurement was according to the protocol used by Junk<sup>15</sup> and Terjesen<sup>27</sup> and colleagues. Briefly, each subject was standing upright, barefoot, with his/her legs at pelvic width (midposition). The scanning head was placed perpendicular to the tissue interface in the hip area. The scanning head was coated with a water-soluble transmission gel to provide acoustic contact without depressing the dermal surface. The highest rim of the femoral head was identified from the ultrasonic image and marked while the scanning head was still attached perpendicular to the skin. Then, the distance from that mark to the floor was measured using a Nedo mEssfix<sup>b</sup> rule. The mEssfix is a telescopic rule made out of rectangular-section aluminum tubes and is designed to measure inside dimensions. The rule is equipped with a 2-way spirit level to ensure accurate horizontal and vertical alignment. The extended length of the mEssfix is shown in a viewing window (display). The high-precision measuring tape and the heavy-duty rewind mechanism of the rule ensure accurate measurements. The mEssfix was placed on the floor and the telescopic tubes were extended to reach the skin mark. The distance reading was then obtained from the display of the rule, and this measurement was considered to be the length of the leg. We conducted this measurement 3 times for each leg (each time, the examiner erased the previous mark), and the value of the leg length for each leg was the average of the 3 measurements. The LLD was then calculated by subtracting the "shorter" leg distance from the "longer" one.

### Reliability of the Ultrasonographic Measurement

In 3 patients, we compared the leg lengths obtained with the above-mentioned method with radiographic measurements that are considered to be the most accurate.<sup>28</sup> The mean difference  $\pm$  SD between LLDs measured with ultrasound and LLDs

**Table 1: Reliability Analysis of Leg-Length Measurements Obtained With Ultrasound**

Side	Mean Length (mm)	MSE	ICC
Right	1. 843.2 $\pm$ 36.3	.023	.99
	2. 843.3 $\pm$ 36.7		
	3. 843.4 $\pm$ 36.4		
Left	1. 843.9 $\pm$ 36.5	.197	.99
	2. 843.9 $\pm$ 36.6		
	3. 844.3 $\pm$ 37.1		

NOTE. Values are mean  $\pm$  SD.  
Abbreviation: MSE, mean square error.

measured with radiography was  $0.8 \pm 1$ mm. This small difference is important when LLDs of 10mm and less are to be identified. We also calculated the intraclass correlation coefficients (ICCs) of the 3 measurements obtained with ultrasound for the entire group as an index of the reproducibility and found excellent agreement between repeated measurements (.99 for the right and left legs) (table 1), indicating high reproducibility of measurements. Also, the very low mean square error between repeated measures (.023 and .019) and the mean difference  $\pm$  SD between leg-length measurements ( $.16 \pm .05$ ) suggest that the ultrasonographic measurement conducted here can detect an LLD less than 10mm.

### Procedure

Patients were randomly divided into the study and the control groups in a 2:1 ratio as follows: the first patient in the list was assigned to the control group, the second and third patients to the treatment group, the fourth patient to the control group, and so on. A total of 22 patients were allocated to the study group and 11 to the control group. Neither patients nor investigators were blinded. However, the randomization scheme was performed so that potential investigator biases would be minimal; investigators did not know patients by their names, because the list from which the patients were assigned to the 2 groups was by numbers. All patients were interviewed and completed a general questionnaire regarding their ADLs (including the number of hours [a week] spent standing, walking, sitting, working, performing physical activity, etc) during working hours and leisure time. Patients were also asked about their general health, including the use of medication.

In addition, all patients filled out the Roland-Morris Disability Questionnaire (RMDQ).<sup>29</sup> This self-administered questionnaire, frequently used by people with LBP, contains 23 sentences (eg, "I stay at home most of the time because of my back," "I change position frequently to try and get my back comfortable," "Because of my back, I lie down to rest more often"). Each subject is asked to read the sentences and mark the ones that best describe his/her condition at present. The number of sentences marked by the subject is the disability score. Lower scores represent more desirable health status. The RMDQ has been shown to yield 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. Patients were also asked to rate their LBP on a visual analog scale (VAS). The VAS consisted of a 15-cm line with endpoints set at 0 (no pain sensation) and maximal length (most intense pain imaginable).<sup>30</sup> The patient was instructed to point on the line to the intensity of his/her LBP, and the distance from 0 line length to that point was the estimated LBP intensity. The outcome measures were taken at baseline and at the end of the follow-up period.

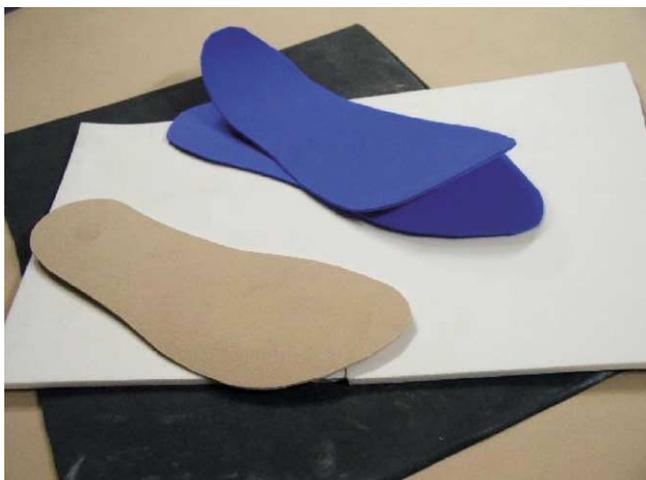


Fig 1. The elastic shoe insert used for correction of LLD.

Only patients from the study group were treated for their LLD. They each were given a shoe insert, made of an elastic smooth plastic material (Sol)<sup>c</sup> of 2-mm thickness to put inside the shoe of the “shorter” leg (fig 1). The shoe insert was cut in the shape and size of each patient’s foot. The height of the shoe insert was adjusted gradually. The minimal height at baseline was 2mm. Further elevations (of 2mm each) were added every 2 days. This was continued until the desirable height was achieved. During weight bearing the Sol is compressed by 10% of its original thickness, and therefore the correction of LLD was equal to the LLD minus 10%. Patients were then asked to wear the shoe insert all day long for at least 12 weeks. We instructed all patients to notify us if they wished to withdraw from the experiment earlier. In such cases, the evaluation of the outcomes was performed at time of withdrawal.

### Data Analysis

Analysis was performed with SPSS, version 11, software.<sup>d</sup> Differences between the groups in the pain (P) and disability (Q) scores (baseline scores, end of study scores, delta [ $\Delta$ ] scores), ADL scores, degree of LLD, duration of LBP, and sociodemographic data (eg, age, sex) were evaluated with analysis of variance for repeated measures and with post hoc *t* tests. This analysis was performed twice; once including all the patients in each group and once excluding the 4 patients who stopped wearing the shoe insert before the end of the study. Because the results obtained in the 2 analyses were similar, we present in the following section the results obtained for all patients. Within the study group that received the shoe insert, we evaluated the effect of the degree of LLD, duration of LBP, duration of wearing the shoe insert, and age on the change in pain and disability scores. Correlations between any 2 variables were tested as well. Probability of *P* less than .05 was considered statistically significant. Data are presented as mean  $\pm$  SD.

### RESULTS

The mean duration of shoe insert wearing  $\pm$  SD was 10 $\pm$ 2 weeks (range, 5–12wk). Four patients withdrew from the experiment before the end of the 12-week follow-up: 2 patients had to travel abroad after 8 and 9 weeks, and although they said they would continue wearing the shoe insert because they were content with its effect, we performed their assessments after 8 and 9 weeks. The other 2 patients removed the inserts after 5

weeks because they could not wear shoes in summer. We performed their assessments after a follow-up period of 5 weeks.

Table 2 describes the characteristics of the study and the control groups at baseline. No significant differences were found between the groups in LLD, age, duration of LBP, level of physical activity, and ADL and disability scores. However, chronic pain intensity in the study group was significantly higher than that of the control group.

Table 3 summarizes the differences between the study (1) and control (2) groups in LLD and outcome measures. We found a significant difference between the groups in the change in VAS scores relative to initial values ( $P<.001$ ). The mean baseline VAS scores of the study group (mean, 4.8 $\pm$ 1.7) were significantly higher than those of the control group (mean, 3.1 $\pm$ 1.6) ( $P<.05$ ), whereas VAS scores of the study group at the end of the follow-up were significantly lower than those of the control group ( $P<.05$ ). Within the study group, VAS scores decreased significantly after wearing the shoe lift, to a level of 2 $\pm$ 1.6 ( $P<.001$ ), whereas those of the control group did not change significantly.

Figure 2 shows the individual VAS scores at baseline (P1) and after wearing the shoe lift (P2). A reduction in VAS scores was obtained in all patients wearing shoe lifts. Patients 1, 3, 4, 10, and 11, obtained complete pain relief after wearing the shoe lift (fig 2).

A significant difference between the groups was found in the change in disability scores relative to initial values ( $P<.05$ ). We found no significant differences between the study and control groups at baseline (Q1) (4.5 and 4.9, respectively) and at the end of the follow-up period (Q2) (3.4 and 5.2, respectively). However, the change in disability scores (Q2–Q1) in the study group was significantly larger compared with the control group ( $P<.05$ ) (see table 3).

The degree of LLD did not correlate with P1, Q1, or any of the ADL components (eg, walking hours, physical activity hours). The correlation between LLD and  $\Delta P2$ –P1 was moderate ( $r=.48$ ,  $P=.063$ ); patients with larger LLDs had relatively larger reductions in pain intensity after wearing the shoe insert. The correlation between duration of LBP and  $\Delta P2$ –P1 was also moderate ( $r=.45$ ,  $P=.056$ ); patients with longer duration of LBP had relatively larger reductions in pain intensity after wearing the shoe insert. Duration of shoe insert wearing did not correlate with the outcome measures  $\Delta P2$ –P1 and  $\Delta Q2$ –Q1.

### DISCUSSION

Our aim was to study whether the conservative correction of an LLD of 10mm or less can relieve CLBP. Shoe inserts

Table 2: Characteristics of the Study and Control Groups

Characteristics	Study Group (Shoe Insert)	Control Group (No Shoe Insert)
LLD (mm)	5.6 $\pm$ 2.2	5.1 $\pm$ 2.1
Age (y)	43.4 $\pm$ 11.8	48.2 $\pm$ 6.9
Physical activity (h/wk)	2.5 $\pm$ 3.9	2.0 $\pm$ 1.9
Walking (h/wk)	23.5 $\pm$ 11.5	19.3 $\pm$ 11.8
Standing (h/wk)	23.0 $\pm$ 15.5	22.4 $\pm$ 9.5
Working (h/wk)	39.6 $\pm$ 11.8	43.1 $\pm$ 13.3
LBP intensity (P1)	4.8 $\pm$ 1.7	3.1 $\pm$ 1.5*
LBP duration (y)	12.2 $\pm$ 9.2	17.5 $\pm$ 12.9
Disability score (Q1)	4.5 $\pm$ 2.1	4.9 $\pm$ 2.9

NOTE. Values are mean  $\pm$  SD.

\* $P<.05$ , 2-tailed test between the groups.

**Table 3: LLD and Outcome Measures in the Study (1) and Control (2) Groups**

Variable	Group	Mean	Mean Difference
LLD	1	5.6±2.2	0.5
	2	5.1±2.1	
Pain scores: baseline	1	4.8±1.8	1.7*
	2	3.1±1.6	
Pain scores: end of study	1	2.1±1.6	-1.4*
	2	3.5±1.7	
% pain reduction (-)/gain (+)	1	-58.0±27.0	70.8*
	2	+12.8±18.0	
Disability scores: baseline	1	4.5±2.1	-0.4
	2	4.9±2.9	
Disability scores: end of study	1	3.4±3.9	-1.8
	2	5.2±2.8	
Change in pain scores	1	2.7±0.9	3.1*
	2	-0.4±0.5	
Change in disability scores	1	1.1±2.1	1.4*
	2	-0.3±1.1	

NOTE. Values are mean ± SD.

\*P&lt;.05, 2-tailed test between the groups.

applied for several weeks significantly reduced both LBP intensity (VAS scores) and disability scores (RMDQ). The reduction in disability scores was relatively small. However, the fact that these 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. These results were obtained even though the duration of shoe insert wearing was in some cases shorter than that originally planned. Although 2 patients stopped wearing the shoe insert after 5 weeks, most patients continued wearing it 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 ADLs. Patients of the control group who did not receive shoe inserts did not have any changes in either LBP intensity or disability scores.

The results of this study agreed with those of Irvin,<sup>23</sup> who found a significant reduction of LBP in professional dancers after mild LLD correction with heel lifts. Our results also agree with those of others who applied a heel lift to patients with LBP with various LLDs (10–25mm).<sup>4,6,20</sup> In contrast to these studies, however, we 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.<sup>18</sup> This is very important in patients with LBP who might already exhibit contracted musculature and an abnormal spinal curvature.<sup>18</sup>

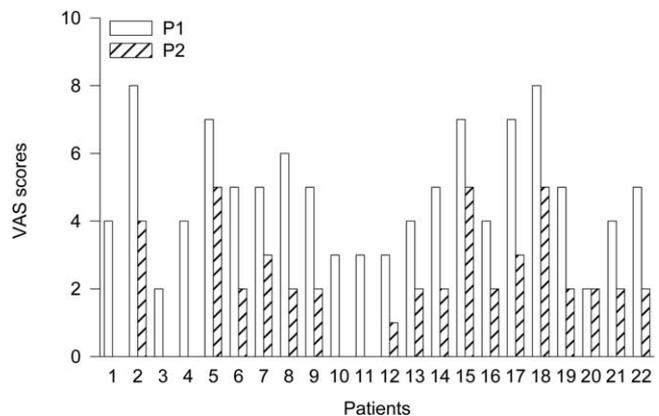
Shoe inserts are a noninvasive, inexpensive, and readily available therapeutic measure. The shoe inserts used in this study can easily be prepared and adjusted to patients by any trained physiotherapist. Based on the results of this study and the feasibility of the intervention used herein, shoe inserts appear to be a possible treatment for LBP for patients who have an LLD of 10mm 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. One disadvantage of the shoe insert is that it requires space in the shoe and thus

seems less comfortable with sandals. This should be considered when such a treatment is contemplated.

Patients included in this study had an LLD of 10mm or less (mild LLD). Mild LLD is common in as many as 96% of the adult population, significantly more than moderate to severe LLD.<sup>11,15</sup> In the process of patient recruitment for this study, all patients with LBP who were screened had an LLD of 10mm or less. However, patients with mild LLD are rarely referred to a conservative LLD correction,<sup>31,32</sup> let alone to a surgical correction.<sup>21</sup> 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.

Although the effect of mild LLD on the musculoskeletal system is presently controversial,<sup>4-6,17,18,20,21,33</sup> patients with mild LLD have been shown to have abnormal radiologic findings compared with controls, such as wedging of the lumbar vertebrae, concavities of the lumbar vertebral endplates, and osteophytes of the vertebral bodies.<sup>17,34</sup> Patients with mild LLD were also found to have scoliosis or altered lordosis.<sup>5,19</sup> Recently, it was found that in most patients with herniated disks and a mean LLD of 5mm, pain was projected to the shorter leg.<sup>7</sup> In accordance with the above evidence, the prevalence of LBP among patients with mild LLD was found to be significantly higher compared with those without LLD.<sup>4,5</sup>

The mechanism by which LLD affects the lumbar spine is not clear. It was suggested that LLD causes pelvic obliquity with or without associated lumbar scoliosis<sup>5,16</sup> and also to sacroiliac malalignment.<sup>35</sup> Consequently, asymmetry develops in the work performed by the muscles and ligaments that stabilize the low back<sup>11,36</sup> and uneven forces are exerted on the lumbar and sacroiliac joints. This may lead to pathologic changes in the lumbar and sacral spine and in soft tissue<sup>8,9,17,34</sup> and in turn, to CLBP. The asymmetry may also lead to facet arthrosis, lumbar endplate concavity, wedging of the L5 vertebra, lateral disk compression, and other changes, all of which may lead to LBP.<sup>4,11,37,38</sup> The application of a shoe insert to the shorter leg might eliminate the length discrepancy between the legs, presumably resulting in a correction of potential obliquity of the pelvic and lumbar spine. Our results show that a shoe insert that might partially correct abnormal positions of the pelvic or vertebral column due to LLD might be beneficial for these patients. Five patients had complete pain relief, and 16



**Fig 2. Individual LBP intensity (VAS) scores of patients in the study group, at baseline (P1) and at the end of the follow-up period of wearing the shoe insert (P2). A reduction in LBP was observed in all patients.**

patients had substantial pain reduction, ranging between 33% and 72% (mean, 48.5%). Only 1 patient did not have pain relief.

The correlation between LLD and pain and disability scores at baseline was not significant. Before the study, we expected that larger LLD would have manifested in stronger degrees of LBP and, hence, in disability. A lack of correlation between the degree of LLD and the intensity of LBP was also reported by others.<sup>39-41</sup> It is possible that the crucial factor influencing the intensity of LBP is the mere presence of LLD and not its exact degree. Alternatively, other factors directly or indirectly associated with LLD might affect LBP. It is also possible that the range of LLD in our patients (1–10mm) is too narrow to reveal such a correlation. Patients with LLDs of various sizes herein benefited from the shoe insert regardless of how long they wore it. The minimal duration of shoe insert wearing recorded here was 5 weeks. In a previous analysis (not presented here), we found that there was no significant difference in pain relief between patients who wore the insert below compared with above the group mean duration. It is therefore probable that the major effect of the shoe insert starts soon after the beginning of its application and the effect is then maintained.

An important advantage of our study is the use of ultrasound to measure leg length. Ultrasound is a safe, accurate, and reproducible measurement of leg length<sup>15,27,42,43</sup> and is also relatively easy to perform. In this study, a physiotherapist performed the measurement after being trained by an ultrasound specialist. Most important, ultrasound enables the identification of an LLD of 10mm or less. Other accurate and reproducible measuring methods are radiographic and imaging techniques.<sup>44,45</sup> However, patients are exposed to radiation in some techniques, and others (eg, computerized tomography, magnetic resonance imaging) are very expensive and not feasible for physiotherapists. The more clinical methods of simply measuring the distance between fixed bony landmarks with a tape measure<sup>46</sup> or using blocks under the short leg and visually examining the pelvis level<sup>47</sup> 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.<sup>15,48</sup> Consequently, these methods exhibit low accuracy, reliability, and validity.<sup>16,26,48,49</sup> In contrast, ultrasonography has good accuracy and reproducibility.<sup>15,27,42,43</sup> Keppler<sup>42</sup> and Junk<sup>15</sup> and colleagues reported that the accuracy of the ultrasound method is  $\pm 3.2$  and 5mm, respectively, and in this study it was  $\pm 2$ mm. Clearly, clinical methods are not suitable for the identification of an LLD of 10mm or less, whereas ultrasonography is suitable for this purpose. Therefore, we recommend using ultrasonography for the identification of LLD in patients with LBP.

## CONCLUSIONS

This study suggests that the correction of an LLD of 10mm 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.

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