

General

Impact of Sacroiliac Belt Utilization on Balance in Patients with Low Back Pain

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Background

Low back pain (LBP) is a common problem which can affect balance and, in turn, increase fall risk. The aim of this investigation was to evaluate the impact of a Sacroiliac Belt (SB) on balance and stability in patients with LBP.

Methods

Subjects with LBP and without LBP (“Asymptomatic”) were enrolled. Baseline balance was assessed using the Berg Balance Scale. In a counterbalanced crossover design, LBP and Asymptomatic subjects were randomized to one of two groups: 1) start with wearing the SB (Serola Biomechanics, Inc.) followed by not wearing the SB or 2) start without wearing the SB followed by wearing the SB. For subjects in both groups, dynamic balance was then assessed using the Star Excursion Balance Test (SEBT) with each leg planted.

Results

Baseline balance was worse in LBP subjects (Berg 51/56) than Asymptomatic subjects (Berg 56/56) ($p < 0.01$). SB significantly improved SEBT performance in LBP subjects regardless of which leg was planted ($p < 0.01$). SB positively impacted Asymptomatic subjects’ SEBT performance with the left leg planted ($p = 0.0002$).

Conclusion

The Serola Sacroiliac Belt positively impacted dynamic balance for subjects with low back pain. Further research is needed to examine additional interventions and outcomes related to balance in patients with back pain, and to elucidate the mechanisms behind improvements in balance related to sacroiliac belt utilization.

BACKGROUND

Low back pain (LBP) is a common condition that significantly impacts an individual’s daily activities and overall quality of life.¹⁻³ LBP affects up to 84% of the general population, has high rate of recurrence,⁴ and is associated with a large and increasing economic burden.⁵ LBP can also affect neuromuscular coordination, alter stability and balance,⁶ and, in turn, increase the risk of falls—especially in the elderly population.⁷

Back braces are a non-invasive, safe management option for patients with LBP.⁸⁻¹⁰ Lumbar orthotics often offer an affordable alternative to surgical treatment and is often accompanied by physical therapy and medication. The brace helps provide support and stabilize the spine, reducing pain that may be caused by movement.⁹ This stabilization helps to limit unnecessary movements and can help prevent excessive strain that may exacerbate LBP.¹¹ Lumbar orthotics

have also been shown to improve postural control and functional status of users.¹⁰⁻¹³ There are many possible sources of LBP, however sacroiliac joint dysfunction is a common cause of LBP among adults.¹⁴⁻¹⁶ Serola Sacroiliac Belts have shown to have positive effects in LBP patients, demonstrating higher user satisfaction and similar effectiveness to traditional lumbar orthosis.^{17,18} The aim of this study is to evaluate the impact of Serola Sacroiliac Belt on balance and stability in patients with LBP.

METHODS

ETHICAL CONSIDERATIONS

The study was approved by the Lifespan Institutional Review Board. Adult (>18 years old) subjects with and without LBP were recruited to participate at an academic medical center spine center. Eligible LBP subjects were individuals

seeking care for LBP, recommended for a back brace by their provider as part of their clinical care, and oral and written consent was obtained to participate in the study. “Asymptomatic” subjects were healthy volunteers without LBP in individuals who consented to participate in the study.

EQUIPMENT

Designed to stabilize and support the sacroiliac joints, the Serola Sacroiliac Belt, (Serola Biomechanics, Inc., Loves Park, IL)¹⁷ or SB, was utilized. The SB wraps around the hip at the inguinal crease and can be adjusted with additional elastics in a posterior to anterior motion.

STUDY DESIGN

After informed consent was obtained, all subjects performed the Berg Balance Scale to evaluate their baseline balance. The Berg Balance Scale is a validated 14-item scale designed to measure the fall risk and balance of older adults in a clinical setting.¹⁹ Each task is graded with a score from 0 to 4 points with a total possible score of 56 points.

LBP were randomized into two groups: “brace” or “no brace” to complete the Star Excursion Balance Test (SEBT). The SEBT is a validated measure of “dynamic balance, multi-planar excursion and postural control” in chronic low back pain patients.²⁰ SEBT is performed by balancing on one leg and the measurement (in cm) of outreach with the opposite leg in 8 different directions—anterior, anterolateral, lateral, posterolateral, posterior, posteromedial, medial, and anteromedial.²¹ The first group (“brace”) performed the SEBT wearing the SB, followed by a 5-minute washout period, and then repeat SEBT without wearing the SB. The second group (“no brace”) performed the SEBT without the SB first, followed by a 5-minute washout period, and then repeat SEBT wearing the SB. Therefore, all subjects (regardless of group) wore the SB at some point during the measurement period and underwent the same number and type of balance tests. Asymptomatic subjects completed the same randomization and balance test protocols.

STATISTICAL ANALYSIS

All statistical analyses were performed using Excel (Microsoft Corporation, Redmond, WA).²² Mean scores and standard deviations were used to evaluate baseline balance. Paired two-sample t-tests for means were used to explore the impact of the SB within groups. The statistical significance was set at $p < 0.05$.

RESULTS

SUBJECTS AND BASELINE BALANCE

Twenty subjects were enrolled into this study consisting of 10 LBP and 10 Asymptomatic subjects. The mean age of the Asymptomatic subjects was 24.5 years old and 47.75 years old for LBP subjects. (Table 1). All Asymptomatic subjects scored a perfect Berg Balance score (56/56). LBP subjects

scored an average of 51/56 with a range of 45 to 56 and a standard deviation of 4.

DYNAMIC BALANCE

Average SEBT scores for each condition (each leg planted, with and without a SB), and it was found that the use of the SB had a statistically significant impact ($P < 0.01$) on both Asymptomatic and LBP subjects (Table 2).

The average percent change the SB had on performance in LBP subjects showed consistent positive increases up to 590%. In Asymptomatic subjects, the left-planted also showed a positive increase in SEBT performance (Table 3).

When all subject data was analyzed together, there was a significant difference ($P < 0.05$) in SEBT scores with use of SB usage for the left leg planted group (Table 4). The average SEBT percent change impact the SB had overall on all subjects was positive in six of the eight directions (Table 5).

DISCUSSION

This randomized crossover clinical study evaluated the impact of the Serola Sacroiliac Belt on balance in subjects with low back pain. The present investigation demonstrates that LBP subjects have worse baseline balance but that the SB significantly improves dynamic balance.

LBP is a widely prevalent chronic condition that has a significant impact on an individual’s daily life.¹⁻³ The economic burden of LBP is significant; in the US alone, the total costs of LBP are estimated to exceed \$100 billion per year, two-thirds of which are indirect costs such as lost wages and reduced productivity.²³ In addition to its economic burden, LBP is also associated with an increased risk of falls.²⁴ LBP can affect neuromuscular coordination, and patients with LBP have reduced lumbar ROM²⁵ and impaired static balance.²⁶ Falls are common in older adults,²⁷ with an estimated one-third of all adults older than 65 experiencing at least one fall annually.^{28,29} Annually, \$50 billion is spent on geriatric fall-related medical expenses in the US.^{30,31}

There is a wide range of treatment and management options for LBP.⁸ Pharmacologic and nonpharmacologic options are used in combination, and while interventional surgical approaches are also available, patients are not commonly candidates for such invasive options. Back braces and spinal orthotics are a cost-effective, safe, and non-invasive option for LBP.⁸⁻¹⁰ Back braces provide support to the lumbar spine, stabilize the area, and limit movement to relieve LBP.¹³ The use of spinal orthotics has been shown to improve functional activity and postural control, providing benefit to daily activities.^{12,13}

In a literature review, Barbosa et al.³² identified a relationship between “treatment satisfaction and patients’ compliance, adherence, and/or persistence,” and concluded that “greater treatment satisfaction was associated with better compliance and improved persistence, and with lower regimen complexity or treatment burden.” For LBP subjects, Lee et al.¹⁸ demonstrated that SB had significantly higher user satisfaction with the SB which was associated

Table 1. Demographic and Baseline Balance Data of Subjects

	Asymptomatic	LBP
Mean Age (years)	24.5	47.75
Gender		
Female	0	5
Male	10	4
Berg Balance		
Average Score	56	51
SD	0	4
p-value	0.005	

*\Some LBP subject demographic data not available

Abbreviations: LBP, low back pain; SD, standard deviation

Table 2. Raw Average SEBT Performance

Asymptomatic - AVG	A	AL	L	PL	P	PM	M	AM	p-value
NO SB - R	45.3	37.7	29.1	37.3	42	48.5	55.6	55.7	0.0018
WITH SB - R	44.3	35.4	26.9	36.4	40.9	44.8	51.2	53.7	
NO SB - L	44.7	38.9	30.2	35.6	41.1	47.1	56.1	53.6	
WITH SB - L	46.3	39.6	31.9	36.8	41.9	49.2	56.8	54.9	
LBP - AVG	A	AL	L	PL	P	PM	M	AM	0.0024
NO SB - R	53.75	21.25	31.5	38.875	50.125	53.5	56.25	50	
WITH SB - R	56.625	27.25	40	42.375	55.875	54.875	57.625	53.125	
NO SB - L	53.125	48.375	55.125	52.625	43.25	39.025	30.625	17.375	
WITH SB - L	56.25	53	57.625	56.75	47.375	45	36.625	19.375	

Abbreviations: A, Anterior; AL, Anterolateral; L, Lateral; PL, Posterolateral; P, Posterior; PM, Posteromedial; M, Medial; AM, Anteromedial. All values shown in centimeters (cm).

Note: "NO SB" group performed SEBT without SB and then repeated with SB. "WITH SB" group performed SEBT with SB and then repeated without SB. "R" and "L" show right and left foot planted, respectively.

Table 3. Average Percent Change Impact of SB

Asymptomatic - AVG	A	AL	L	PL	P	PM	M	AM
R-planted	-1.95%	-5.08%	-5.50%	-1.45%	-2.34%	-4.96%	-8.77%	-3.78%
L-planted	3.82%	2.85%	5.94%	5.81%	2.19%	5.05%	1.30%	2.71%
LBP - AVG	A	AL	L	PL	P	PM	M	AM
R-planted	6.89%	336.96%	590.72%	19.08%	19.61%	2.29%	1.80%	6.61%
L-planted	6.00%	9.22%	4.48%	10.82%	15.82%	260.25%	482.91%	5.14%

Abbreviations: A, Anterior; AL, Anterolateral; L, Lateral; PL, Posterolateral; P, Posterior; PM, Posteromedial; M, Medial; AM, Anteromedial. All values shown in centimeters (cm).

Note: "R-planted" and "L-planted" groups show right and left foot planted during SEBT, respectively.

Table 4. All Subject Raw Average SEBT Performances

Group	A	AL	L	PL	P	PM	M	AM	p-value
NO SB - R	49.525	29.475	30.3	38.0875	46.0625	51	55.925	52.85	0.148
WITH SB - R	50.4625	31.325	33.45	39.3875	48.3875	49.8375	54.4125	53.4125	
NO SB - L	48.9125	43.6375	42.6625	44.1125	42.175	43.0625	43.3625	35.4875	
WITH SB - L	51.275	46.3	44.7625	46.775	44.6375	47.1	46.7125	37.1375	

Abbreviations: A, Anterior; AL, Anterolateral; L, Lateral; PL, Posterolateral; P, Posterior; PM, Posteromedial; M, Medial; AM, Anteromedial. All values shown in centimeters (cm).

Note: "NO SB" group performed SEBT without SB and then repeated with SB. "WITH SB" group performed SEBT with SB and then repeated without SB. "R" and "L" show right and left foot planted, respectively.

with improvements in functional disability, pain magnitude and pain frequency. Sacroiliac (SI) joint dysfunction is the

Table 5. All (LBP + Asymptomatic) Subject Average Percent Change Impact of SB

Group	A	AL	L	PL	P	PM	M	AM
R-planted	2.50%	165.90%	292.60%	8.80%	8.60%	-1.30%	-3.50%	1.40%
L-planted	4.90%	6.00%	5.20%	8.30%	9.00%	132.70%	242.10%	3.90%

Abbreviations: A, Anterior; AL, Anterolateral; L, Lateral; PL, Posterolateral; P, Posterior; PM, Posteromedial; M, Medial; AM, Anteromedial. All values shown in centimeters (cm). Note: "R-planted" and "L-planted" groups show right and left foot planted during SEBT, respectively.

cause of LBP in 15 to 30% of people.³³ Designed to stabilize the sacroiliac joint,¹⁷ the SB may help in facilitating load transfer between the lumbar spine and lower extremities.³⁴

There are several limitations to this study. In a crossover study design, the potential "carry over" of the first treatment to alter the response of the following treatment. Randomization of the intervention order as well as a 5-minute wash out period between SEBT collection mitigates this effect. A larger sample size could have strengthened the study. However, the present results could inform the expected effect size for larger subsequent studies. Stratifying and randomizing patients by their specific LBP diagnoses may provide further granularity. Additionally, it is important to note that while spinal orthotics have been shown to be useful in the treatment of LBP, their efficacy will vary for each patient. Proper fitting of the brace is crucial, as improperly used orthotics may cause more harm than benefit.

CONCLUSION

LBP affects balance which can increase fall risk. The Serola Sacroiliac may improve balance for those with low back pain. Further research is needed to examine additional interventions and outcomes related to balance in patients with back pain, and to elucidate the mechanisms behind improvements in balance related to sacroiliac belt utilization.

CONTRIBUTIONS

AMP carried out data acquisition, analysis, and drafted the manuscript. DJL carried out data acquisition and analysis. MD helped revise the manuscript and carried out administrative and technical support. BGD and AC helped revise the manuscript. AHD conceived the study, participated in its design and coordination, and helped revise the manuscript. All authors read and approved the final manuscript.

DISCLOSURES

Bassel G. Diebo, MD

Clariance: Consultant

Spinevision: Consultant

Medtronic: Consultant

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