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The importance of lumbar dynamometric examination in patients with low-back pain

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Aim: To investigate whether the Isostation B-200 Lumbar Dynamometer can be used to differentiate patients with low-back pain (LBP) from healthy subjects.

Materials and methods: In this study, range of motion (ROM), maximal isometric torque, maximal velocity, and secondary axle maximal isometric torque values were obtained from 79 patients with mechanical LBP and compared with the values of the control group, which consisted of 62 people. For this purpose, the Isostation B-200 Lumbar Dynamometer was used.

Results: In the group with mechanical LBP the flexion, right and left rotation, and right and left lateral flexion ROM values were significantly lower than those of the control group, whereas there were no significantly statistical differences in extension values. Moreover, the maximal isometric torque, maximal velocity, and secondary axle maximal isometric torque values were significantly lower when compared with the control group on transversal, sagittal, and coronal axes.

Conclusion: It was determined that the maximal isometric torque, maximal velocity, and secondary axle maximal isometric torque are reliable parameters in defining the present pathology of patients with mechanical LBP, whereas ROM parameter is not reliable, although it shows significant variation in some axes.

Key words: Low-back pain, lumbar dynamometer, torque

1. Introduction

Low-back pain (LBP) is one of the major causes of morbidity, disability, restricted activity, and economic loss. Of the overall population, 60%–80% experience LBP in any stage of their lifespan. In the age group of 45–64 years old, it ranks as the third cause (following cardiac disease and rheumatic diseases) of daily activity limitation (1).

The incidence of LBP is almost identical in men and women. Muscular strength of the lower back and abdomen protects the lower back from injury by decreasing the load placed on the vertebrae. LBP was reported to occur more commonly in people with weak low-back and abdominal muscles (2). The lifetime prevalence of people who suffer from LBP is about 84%. LBP usually leads to disability in activities of daily living and can be very costly. Most patients with acute LBP tend to recover from the pain within 8–10 weeks regardless of the treatment, but many suffer recurrence of the pain, with some experiencing chronic LBP that lasts for more than 6 months (2).

LBP is usually a chronic pain. The link between depression and chronic pain has been studied heavily in recent years, as more and more people are diagnosed with depression each year. Chronic pain is one of the many symptoms of depression, and yet many do not recognize that there is a relationship between chronic pain and depression. Pain or psychological factors, such as depression, could prevent maximal contraction of the muscles, resulting in the recording of strength values that are less than the real values (3).

The types of exercise programs are very important and patient presentations for chronic LBP vary so widely that it is unlikely that all programs are equally effective for all patients (4). For objective evaluation, isokinetic testing is used not only on the neck and lower back, but also on other joints including the ankle (5).

2. Materials and methods

We enrolled patients that were determined to have mechanical LBP for at least 3 months, based on anamnesis, physical examination, radiological examination, and

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routine laboratory investigation. The study consisted of a total of 141 subjects, including 79 patients (39 men and 40 women) and 62 healthy subjects (37 men and 25 women). Healthy subjects had not experienced LBP for the last 6 months. A signed, written informed consent, approved by the local ethics committee, was obtained from all subjects before the study. The patients and the controls were asked to cite their ages, weights, heights, occupations, and daily activity scores during the medical history. Daily activity scores were evaluated as sedentary = 1, mild = 2, moderate = 3, high = 4, and very high = 5.

Complete blood count, erythrocyte sedimentation rate, and lumbosacral radiographs were routinely investigated in the patients and in the controls. Lumbar dynamometric examination was performed using the Isostation B-200 (Isotechnologies, Hillsborough, NC, USA) in the patients and in the healthy controls. The Isostation B-200 is a computerized, triaxle, isoinertial device. Range of motion (ROM), isometric torque, secondary axle torque, dynamic torque, speed, work, and power can be simultaneously measured in sagittal, coronal and transverse axles. The Isostation B-200 device may be used for the test as well as for exercise. The subject to be tested was taken to the testing room and Occupational Orthopedic Center (OOC) test protocol was applied. The patients and the controls were administered the OCC test protocol, which consists of ROM, isometric, and dynamic test sections, following a 10-min to 15-min warm-up period, and the results were compared.

After positioning the subject to be tested in a neutral position, the subject completed the ROM test by doing right rotation, left rotation, flexion, extension, right lateral flexion, and left lateral flexion against a resistance of 1 lb·ft 2 times respectively. In the isometric test, after applying maximum resistances in all the axes (rotation = 63 lb·ft, flexion /extension = 118 lb·ft, lateral flexion = 63 lb·ft), the patient exerted power for 1–2 s according to the Caldwell regimen by doing right rotation, left rotation, right lateral flexion, left lateral flexion, and extension, 2 times respectively, and then completed the testing by conserving his/her position for 2–3 s. Thereafter, maximal voluntary contraction (MVC) values of the isometric tests were determined and we proceeded with 25% and 50% dynamic tests. In the dynamic tests, the patient did 5 repetitions respectively and rapidly along the ROM in all the axes of right rotation, left rotation, flexion, extension, right lateral flexion, and left lateral flexion against the resistances of 25% and 50% MVC. The dynamic test was terminated in the presence of dizziness, severe shortness of breath, nausea, chest pain, neck pain, arm pain, costal pain, new-onset or progressing LBP that began during the test, and test anxiety. The tests were generally well tolerated. Three patients could not complete the test because of dizziness.

The parameters that were used in this study for the evaluation included the following parameters used in right and left rotation, flexion, extension, and right and left lateral flexion:

1. ROM values as a degree (°),
2. Isometric test maximal torque values (lb·ft),
3. Isometric test maximal torque extension/flexion ratio (lb·ft),
4. 50% dynamic test maximum velocity values (degrees/s),
5. 50% dynamic test secondary axle maximum torque values (lb·ft).

The Excel 2007 Statistical Toolbox was used for the statistical analysis. Significance level for the t-test was considered as $P < 0.05$. Data were expressed as mean ± standard deviation (mean ± SD).

3. Results

This study enrolled a total of 79 patients with a diagnosis of mechanical LBP (39 males and 40 females) and a total of 62 healthy control subjects (37 males and 25 females). Patients with LBP and the healthy controls did not show a statistically significant difference in terms of age, weight, height, and daily activity grade (Table 1). P-values ranged between 0.09 and 0.1.

Lumbar ROM test results were compared between the group with LBP and the healthy controls. The difference between right rotation, left rotation, flexion, right lateral flexion, and left lateral flexion ROM values was statistically significant in both men and women with LBP compared to the healthy controls. Extension ROM values were lower in both men and women with LBP compared to the healthy controls, but the difference was not statistically significant (Table 1). Maximum isometric torque values for right rotation, left rotation, flexion, right lateral flexion, and left lateral flexion and extension of the men and women with LBP were significantly lower compared to the healthy controls (Table 2). When isometric test maximum isometric torque extension/flexion ratios were compared between the group with LBP and the healthy controls, the difference between these ratios was found to be statistically significant neither in men nor in women ($P > 0.05$) (Table 2). The sensitivity and specificity of the maximal isometric torque testing are shown in Table 3. When 50% MVC dynamic test maximum velocity values were compared between the group with LBP and the healthy controls, it was determined that the difference between the maximum velocity values for right rotation, left rotation, flexion, extension, right lateral flexion, and left lateral flexion were significantly lower and statistically significant compared to the healthy controls in both men and women (Table 4). The sensitivity and specificity of maximal speed testing are shown in Table 5.

Table 1. The demographic and clinical characteristics of patients and controls (mean ± SD).

	Male			Female		
	Control	LBP*	P1	Control	LBP	P2
Age	23.1 ± 3.5	25.7 ± 4.8	0.06	22 ± 2.4	23.6 ± 4.5	0.09
Weight	74.1 ± 8.3	73.2 ± 7.1	0.8	56.5 ± 4.5	60.5 ± 8.5	0.06
Height	178.2 ± 8	176.1 ± 5.9	0.2	165.5 ± 4.4	163.9 ± 5	0.1
Activity	3.4 ± 0.5	3.1 ± 0.6	0.1	3.3 ± 0.6	3.1 ± 0.6	0.2
Right rotation	43.7 ± 3	41.1 ± 4.6	0.003	43.5 ± 2.5	38 ± 4.8	<0.001
Left rotation	45.0 ± 3.1	41.3 ± 5.2	0.002	45.2 ± 2.2	36.9 ± 7.9	<0.001
Flexion	73.5 ± 6.2	67.9 ± 6.7	0.002	73.2 ± 4.6	68.3 ± 7.5	0.01
Extension	36.7 ± 2.4	36.3 ± 2	0.4	37.1 ± 2.6	35.9 ± 2.2	0.06
Right lat. flex.	46.2 ± 3.8	43.9 ± 5.7	0.04	46.6 ± 3.2	43.6 ± 3.7	0.001
Left lat. flex.	46.4 ± 3.7	43.3 ± 5	0.004	47.7 ± 3.7	43 ± 5.9	<0.001

*LBP: low-back pain, lat. flex.: lateral flexion.
P1: significance between male controls and male patients.
P2: significance between female controls and female patients.

Table 2. Maximal isometric torque test results and extension/flexion ratios in isometric testing (mean ± SD).

	Male			Female		
	Control	LBP	P1	Control	LBP	P2
Right rotation	65.9 ± 7.2	56.6 ± 9.7	<0.001	56.1 ± 10	35.6 ± 12	<0.001
Left rotation	63 ± 5.5	53.2 ± 10	<0.001	52.8 ± 12	31.6 ± 9.7	<0.001
Flexion	129.5 ± 31	87.3 ± 26	<0.001	69.3 ± 16	41.6 ± 16	<0.001
Extension	172.6 ± 32	119.5 ± 30	<0.001	105.1 ± 21	70.2 ± 26	<0.001
Right lat. flex.	133.5 ± 23	103.6 ± 25	<0.001	70.6 ± 19	47.7 ± 14	<0.001
Left lat. flex.	143.7 ± 25	109 ± 27	<0.001	80.1 ± 16	54.6 ± 16	<0.001
Flex. max. isometric torque	129.5 ± 30.9	87.3 ± 26	<0.001	69.3 ± 15.6	41.6 ± 16	<0.001
Ext. max. isometric torque	176.2 ±32.3	119.5 ± 30	<0.001	105.1 ± 21.1	70.2 ± 26	<0.001
Ext./flex. max. isometric torque	1.3 ± 0.2	1.4 ± 0.5	0.7	1.5 ± 0.2	1.8 ± 0.8	0.06

P1: significance between male controls and male patients.
P2: significance between female controls and female patients.

Table 3. The sensitivity and specificity of the maximal isometric torque testing.

	Sensitivity (patients)				Specificity (controls)			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
Right rotation	23 / 39	59	34 / 40	85	24 / 37	65	20 / 25	80
Left rotation	25 / 39	64	35 / 40	88	27 / 37	73	20 / 25	80
Flexion	30 / 39	76	22 / 40	55	28 / 37	76	21 / 25	84
Extension	33 / 39	84	28 / 40	70	31 / 37	84	18 / 25	72
Right. lat. flex.	29 / 39	74	26 / 40	65	27 / 37	73	18 / 25	72
Left lat. flex	31 / 39	79	31 / 40	78	29 / 37	78	19 / 25	76
Mean		73		74		75		77

Table 4. The results of maximal speed testing (mean ± SD).

	Male			Female		
	Control	LBP	P1	Control	LBP	P2
Right rotation	127 ± 27.7	101.5 ± 28.6	<0.001	100.3 ± 13.5	77.8 ± 16.7	<0.001
Left rotation	127 ± 24.2	105.3 ± 27.7	<0.001	101.7 ± 12.3	79.3 ± 18.6	<0.001
Flexion	141.3 ± 26.3	122.1 ± 33	<0.001	128.1 ± 9.9	110 ± 11.6	<0.001
Extension	177.6 ± 32.5	133.2 ± 35	<0.001	161.2 ± 21.2	111.8 ± 30.4	<0.001
Right lat. flex.	149.8 ± 34.9	117.6 ± 33.3	<0.001	118.2 ± 27.8	89.7 ± 24.8	<0.001
Left lat. flex.	153.3 ± 35.8	121.1 ± 31.3	<0.001	113.9 ± 26.9	93 ± 28.1	0.007

P1: significance between male controls and male patients
P2: significance between female controls and female patients

Table 5. The sensitivity and specificity of maximal speed testing

	Sensitivity (patients)				Specificity (controls)			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
Right rotation	21 / 39	53	33 / 40	83	19 / 37	51	19 / 25	76
Left rotation	20 / 39	51	34 / 40	85	19 / 37	51	21 / 25	84
Flexion	19 / 39	49	34 / 40	85	16 / 37	43	20 / 25	80
Extension	30 / 39	77	37 / 40	93	22 / 37	60	22 / 25	88
Right lateral flex.	25 / 39	64	23 / 40	58	21 / 37	57	18 / 25	72
Left lateral flex.	22 / 39	56	15 / 40	38	23 / 37	62	13 / 25	52
Mean		58		74		54		75

Secondary axle maximum torque values were lower and statistically significant in both women and men in the group with LBP (Table 6). Secondary axle maximum torque values in the flexion/extension and lateral flexion axes, when the primary axle was rotation, and secondary axle maximum torque values in rotation and lateral flexion axes, when the primary axle was flexion/extension, in the men and women with LBP were significantly lower compared to the healthy controls (P = 0.000002). Secondary axle maximum torque values in flexion/extension and rotation axes, when the primary axle was lateral flexion, in the men and women with LBP were significantly lower compared to the healthy controls (P = 0.0004). The sensitivity and specificity of the secondary axle value are shown in Table 7.

4. Discussion

Lumbar ROM generally decreases in patients with LBP. Therefore, lumbar ROM has been used for many years in evaluating disability due to LBP. In the study performed using a monitor by Marras and Wongsam (6), the investigators showed a decrease of flexion by 25% and a decrease of extension by 70% in the patients with LBP. Seeds et al. (7) conducted a study using the Isostation B-100 on the patients with subacute LBP and they found a decrease of flexion by 15%, a decrease of extension by 50%, a decrease of total rotation by 30%, and a decrease of total lateral flexion by 26% in men. Female patients showed a greater decrease of flexion by 29%, of extension by 54%, of total rotation by 48%, and of total lateral flexion by 34%. In the study performed by Gomez et al. (8) using

Table 6. The maximal torque results of secondary axle.

		Male			Female		
		Control	LBP	P1	Control	LBP	P2
Primary axle rot.	Flex./ ext.	84.8 ± 21.8	59.7 ± 20.2	<0.001	50.6 ± 15.8	33.1 ± 10.2	<0.001
	Lat. flex.	69.3 ± 4.9	58.7 ± 10	<0.001	60.7 ± 8.3	42.9 ± 11.1	<0.001
Prim. axle flex. / ext.	Rotation	34.9 ± 9	23.6 ± 10	<0.001	21.2 ± 7.2	15.1 ± 7	0.002
	Lat. flex.	28.3 ± 8.7	20.9 ± 9.5	<0.001	21.4 ± 6.1	17.4 ± 7.2	0.02
Prim. axle lat. flex.	Flex. / ext.	74.2 ± 27.8	53.4 ± 19.4	<0.001	42.7 ± 12.8	28.3 ± 11.7	<0.001
	Rotation	51.1 ± 10	43 ± 18.1	0.02	31.7 ± 7.9	24.7 ± 9	0.002

P1: significance between male controls and male patients
P2: significance between female controls and female patients

Table 7. The sensitivity and specificity value of secondary axle

		Sensitivity (patients)				Specificity (controls)			
		Male		Female		Male		Female	
		n	%	n	%	n	%	n	%
Primary axle rotation	Flex. / ext.	28 / 39	72	26 / 40	65	26 / 37	70	18 / 25	72
	Lat. flex.	30 / 39	77	33 / 40	83	26 / 37	70	22 / 25	88
Primary axle flex. / ext.	Rotation	28 / 39	72	22 / 40	55	25 / 37	68	14 / 25	56
	Lat. flex.	26 / 39	67	22 / 40	55	17 / 37	46	11 / 25	44
Primary axle lateral flex.	Flex. / ext.	20 / 39	51	25 / 40	63	21 / 37	57	15 / 25	60
	Rotation	25 / 39	64	25 / 40	63	18 / 37	49	14 / 25	56

the Isostation B-200 on a healthy group that included 85 men and 83 women, they found values of 61.2 ± 8.7 for the flexion, 34.2 ± 1 for the extension, 40.9 ± 5.6 for right-lateral flexion, and 42.2 ± 6.0 for the left-lateral flexion.

A result that was consistent to ours was reported by Carlier et al. (9). They divided the patients into 3 groups as asymptomatic, those with moderate LBP, and those with severe LBP, and they compared the results of maximum velocity, maximum torque, and ROM obtained at sagittal axle. Carlier et al. demonstrated that there was no significant difference among the 3 groups in terms of extension ROM values, despite the significant differences of flexion among them.

Measurement of ROM using the Isostation B-200 seems to be advantageous, because neutral positions are ensured by the device and it may demonstrate asymmetry in the posture or in a movement in any axle. However, while our results and those of Carlier et al. (9) are consistent with each other, inconsistency is seen with other studies. In our study, although the differences between right and left rotation, flexion, and right and left lateral flexion lumbar ROM values were statistically significant in both men and women, it did not seem to completely reflect the difference between the healthy controls and the group with mechanical LBP. Moreover, the difference of extension lumbar ROM values was not statistically significant in both men and women between the healthy controls and the group with mechanical LBP, which was explained by the fact that the Isostation B-200 device did not mechanically allow the extension beyond a given degree.

Dillard et al. (10) demonstrated that the Isostation B-200 was less reliable than goniometry for the measurement of lumbar ROM. Nissan et al. (11) showed in their study on healthy controls that the Isostation B-200 was reliable for measuring isometric torque, maximum velocity, and mean velocity, but was not reliable in measuring ROM values. Parnianpour (12) stated that the Isostation B-200 had a high level of reliability in all planes for the measurement of torque, whereas it did not have the same reliability for ROM. Consequently, there are inconsistencies about the accuracy of the measurement of lumbar ROM performed using the Isostation B-200. It may be claimed that the difference of lumbar ROM values is greater between the healthy controls and the subjects with LBP and that it would be more appropriate to use simpler methods such as goniometry to detect it.

When maximum isometric torque extension/flexion rates obtained using isometric testing were compared between the subjects with LBP and the healthy controls, the difference between these rates was not statistically significant in men or women (Table 2). Our results are consistent with the literature. Maximum isometric torque values of the group with LBP were significantly lower compared to maximum isometric torque values of the healthy controls in both men and women in all planes and axes.

There are also some studies that conflict with our results and the above-mentioned literature results. Addison and Schultz (13) and Nicolaisen and Jorgensen (14) found a difference of muscular strength measurement performed at the lower back area between people with very severe low-back disease and asymptomatic people, but they reported that the low-back muscular strength values of the people with LBP at a polyclinic level were identical to those obtained from healthy people. Balague et al. (15) could not find any difference of isokinetic strength measurements done among 17 school-age children between the subjects with LBP and asymptomatic ones. Despite these contradictory results, there was a consensus that trunk muscles were weaker in the people with LBP compared to healthy subjects. Chronicity was thought to be a factor that increased this weakness and was investigated. Hides (16) found that isometric strength was considerably reduced in people with chronic LBP compared to those with acute LBP. Hultman et al. (17) demonstrated that muscle strength decreased at a greater rate in people with chronic LBP compared to those with intermittent pain. Bouche et al. (18) investigated the relationship between strength measurements and muscular mass. They tested patients who underwent spinal surgery using an isokinetic device at the end of 3 months and they found the muscle strength of the low-back area to be below normal. It was suggested that decreased isometric torque values observed in the people with LBP resulted from the decreased extensor/flexor muscle strength ratio. In healthy people, low-back extension strength is greater than low-back flexion strength. Although there was a decrease in both flexor and extensor strength in the people with LBP, the main loss was suggested to be in the extensor strength. Although this rate varied across the studies, it was stated that 1.3 was the most commonly seen value and that this rate decreased to 0.8–1 in the patient population (19). Our study conflicted with literature findings. In our study, while the maximum isometric torque extension/flexion ratio was 1.4 ± 0.3 in men with LBP and 1.3 ± 0.2 in healthy people ($P = 0.7$), this ratio was 1.8 ± 0.6 in women with LBP and 1.5 ± 0.2 in the healthy controls, and the difference was not statistically significant ($P = 0.06$). A study that gave the results similar to ours was conducted by Newton et al. (20). Using an isokinetic device, they found that isometric muscle strength was lower in people with LBP compared to a normal group, but they could not find a difference in extension/flexion ratio. Based on our results, the patients with LBP experienced considerable losses of low-back muscle strength compared to the healthy controls, but this occurred in both flexor and extensor muscle strength at

an equal rate. Therefore, the extension/flexion maximum isometric torque rates of the patients with LBP and the healthy controls are similar.

The majority of the studies investigated the sensitivity (the likelihood to obtain a positive test result in the presence of a pathologic condition) and specificity (the likelihood to obtain a negative test result in the absence of a pathologic condition) of the measurements. Burdorf et al. (21) found both sensitivity and specificity as 70% in a study that they conducted on workers in a steel factory using an isoinertial device. Deutsch (22) found the sensitivity to be 76%–81% and the specificity to be 75%–88% using the same device in a study conducted on 104 people with LBP and 124 healthy controls. The sensitivity and specificity that we found in our study are shown in Table 7. As seen, our sensitivity and specificity are consistent with the results of the other studies.

Predictive value of the strength test in the prediction of LBP was investigated. Biering and Sorensen (23) monitored people without acute LBP for 1 year and found that the low-back strength values were lower in the people with recurrent LBP compared to those without LBP. However, they observed that there was no difference between those in the early episodes of recurrent LBP and those without LBP in terms of strength values. Mostardi et al. (24) showed in their isokinetic study conducted on 174 nurses that strength measurements were inadequate in the prediction of the LBP.

Consequently, maximum isometric torque is a valuable test to differentiate people with LBP from healthy controls. As the strength decreased in both flexor and extensor muscles in the people with LBP, the maximum isometric torque extension/flexion ratio was equal for the people with LBP and the healthy controls. Therefore, it seems to be questionable to use this ratio to differentiate people with LBP and healthy controls. There were a limited number of studies to investigate whether low-back strength values predicted the LBP.

Leskinen et al. (25) suggested that, in the calculation of the load placed on the lower back, isometric test results led to bias and that the results obtained were below the real load placed on the lower back. Isokinetic devices are devices that perform dynamic measurements, but they also have the problem of constant velocity. Therefore, isoinertial motion seems to be the most appropriate motion model for real life, and isoinertial motion velocity appears to be a sensitive indicator to show the functional status and weakness of the lower back.

In the studies performed using the isoinertial technique, it was demonstrated that people with LBP moved more slowly compared to normal people and that the main decrease was seen in the extension. Our results were consistent with the literature.

Masset et al. (26) found the sensitivity and specificity as 82% in the velocity measurements that they performed by applying a resistance at 50% of MVC in 3 axes using an isoinertial device on the workers of steel industry.

In our study, mean sensitivity was 66% (58% in men and 74% in women) and specificity was 65% (54% in men and 75% in women) (Table 5). Although our results were slightly lower than those of Masset et al. (26), the maximum results were obtained with extension in both men and women. For the extension, the sensitivity was 77% in men and 93% in women, and the specificity was 60% in men and 88% in women.

Secondary axle activity was proposed to be used to differentiate healthy controls and subjects with LBP and to define the weakness of low-back muscles. In the studies performed by McIntyre and Glower (27), it was suggested that the subjects with LBP showed less secondary axle activity compared to normal subjects. Parnianpour (28) investigated secondary axle activity in an isometric test performed on 20 normal men. When the torque that occurred in the primary axle was considered as 100, it was seen that the maximum pairing was in the rotation axle and the minimum pairing was in the flexion/extension axle. Our results were consistent with the results of Parnianpour. In our healthy controls, maximum secondary axle torque values were obtained in the rotation axle (transverse), which was followed by lateral flexion axle (frontal), and the minimum values were obtained in the flexion/extension axle (sagittal) (Table 6). As seen, maximum sensitivity and specificity values for the differentiation of healthy controls and subjects with mechanical LBP were obtained in the rotation (Table 7). McIntyre and Glover (27) demonstrated that there was only a poor correlation between secondary axle activity and the ability to form velocity and maximum isometric torque in the primary plan. Therefore, secondary axle activity provides valuable contributions in the determination of normal people and people with LBP. The study performed by Parnianpour (28) showed that the weakness of the flexion/extension axle caused a decrease of motor control and abilities, leading to adverse effects on the movement pattern (angular position and velocity) and motor output (torque). Therefore, the weakness and decreased motor control and coordination may be stated to be an important factor that leads to LBP in people who work in stooping positions. Thereafter, with some additions, Parnianpour (28) explained the mechanism of LBP formation as follows: the decrease of functional capacity observed in the primary muscles was compensated by secondary muscle groups. Impaired motor output and movement pattern prevent these muscles from contributing to the phenomenon. The tired muscles, in this case, suffer from more loading and are obligated to give more response, leading to deficiency and LBP. In

conclusion, secondary axle activity may be safely used to differentiate healthy populations and the population with LBP. It seems most likely that the decrease of secondary axle activity accounts for the formation of LBP.

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