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The Effect of Physical Therapy and Core Stabilization Exercises in Failed Back Surgery Syndrome

Başarısız Bel Cerrahisi Sendromunda Fizik Tedavi ve Kor Stabilizasyon Egzersizlerinin Etkisi

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ABSTRACT Objective: Failed back surgery syndrome (FBSS) has risen steadily worldwide, it has become an important medical and socioeconomic problem. The purpose of our study was to investigate the effect of a combination of lumbar core stabilization exercises, transcutaneous electrical nerve stimulation (TENS) and hot-pack application on pain, function, and quality of life in FBSS patients. **Material and Methods:** Fifty patients with the complaint of back and/or leg pain that persisted after previous lumbar spine surgery were included in the study. The patients were divided into 2 groups using the random numbers table. In Group 1, TENS and hot-pack were applied over the lumbar region and performed lumbar stabilization exercises, for a total of 20 sessions. In the control group (Group 2), the patients received none of the above therapy or exercise program. Patients in the control group were placed on the waiting list because of the ethics commitee desicion. At the end of the study, the same treatment was applied to these patients. All patients were evaluated with visual analogue scale (VAS), Oswestry Disability Index (ODI), Short Form-36 (SF-36) before, and 4 and 12 weeks after the start of the study. **Results:** Comparison of the 2 groups showed significantly better improvement in Group 1 for the parameters of VAS and ODI and both at 4th ($p<0.001$) and 12th (VAS $p<0.001$-ODI $p=0.004$) weeks. As for the SF-36 sub-parameters; improvement was superior in Group 1 for all but physical role, social functionality, emotional role, and mental health at 4 weeks, and for all but emotional role, mental health, and mental component at 12 weeks. **Conclusion:** The results of our study showed that physical therapy and core stabilization exercises have positive effects on pain, functional status and quality of life in patients with BBCS.

Keywords: Failed back surgery syndrome; physical therapy; core stabilization exercises; quality of life

ÖZET Amaç: Başarısız bel cerrahisi sendromu (BBCS), görülme sıklığı gittikçe artan önemli bir medikal ve sosyoekonomik durumdur. Çalışmamızın amacı, BBCS hastalarında lomber kor stabilizasyon egzersizleriyle kombine edilen transkutanöz elektriksel sinir stimülasyonu [transcutaneous electrical nerve stimulation (TENS)] ve "hot-pack" tedavisinin; ağrı, fonksiyon ve yaşam kalitesi üzerine etkisini araştırmaktır. **Gereç ve Yöntemler:** Çalışmaya geçirilmiş lomber omurga ameliyatı sonrası devam eden sırt ve/veya bacak ağrısı şikâyeti olan 50 hasta dâhil edildi. Hastalar, rastgele sayılar tablosu kullanılarak 2 gruba ayrıldı. Grup 1'de lomber bölgeye TENS ve "hot-pack" uygulanarak toplam 20 seans lomber kor stabilizasyon egzersizleri yapıldı. Kontrol grubunda (Grup 2), hastalar yukarıdaki terapi veya egzersiz programlarından hiçbirini almadı. Kontrol grubundaki hastalar, etik kurul kararı ile bekleme listesine alındı. Çalışma bitiminde bu hastalara aynı tedavi uygulandı. Tüm hastalar, çalışma başlangıcından önce ve 4 ve 12 hafta sonra vizüel analog skala (VAS), Oswestry Özürlülük İndeksi (Oswestry Disability İndex (ODİ), Kısa Form-36 [Short Form-36 (SF-36)] ile değerlendirildi. **Bulgular:** İki grubun karşılaştırılmasında, Grup 1'de VAS ve ODİ parametrelerinde hem 4 ($p<0,001$) hem de 12. (VAS $p<0,001$-ODİ $p=0,004$) haftada önemli ölçüde daha iyi gelişme saptandı. SF-36 alt parametrelerinde ise 4. haftada fiziksel rol, sosyal işlevsellik, duygusal rol ve zihinsel sağlık dışındaki parametrelerde ve 12. haftada duygusal rol, akıl sağlığı ve zihinsel bileşen hariç tüm parametrelerde Grup 1'de iyileşme daha iyi olarak gözlendi. **Sonuç:** Çalışmamızın sonuçları, BBCS'li hastalarda fizik tedavi ve kor stabilizasyon egzersizlerinin ağrı, fonksiyonel durum ve yaşam kalitesi üzerinde olumlu etkilerinin olduğunu göstermiştir.

Anahtar Kelimeler: Başarısız bel cerrahisi sendromu; fizik tedavi; kor stabilizasyon egzersizleri; yaşam kalitesi

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Failed back surgery syndrome (FBSS) is described as a condition mainly characterized by persistent or recurring lower back and/or leg pain in the patients who has a history of one or more surgical operations on the lumbar spine.[1,2] It is defined by the International Association for the Study of Pain as "lumbar spinal pain of unknown origin that persists despite surgical intervention or occurs after surgical intervention for spinal pain in the original topographic location".[3] As the incidence of FBSS has risen steadily worldwide, it has become an important medical and socioeconomic problem that has led to substantial increase in treatment costs and work force loss incurred by the patients and the society.[4] The increased frequency of FBSS cases has obviously paralleled the steady increase in the number of lumbar spine surgical operations during the past few decades. The incidence of FBSS has been estimated to be within a range of 10 to 40% in several reports.[5] It has also been emphasized that significant discrepancy may occur between the operative success assessed by the surgeon and the satisfaction perceived by the patient. The general principles of FBSS treatment can be outlined as relieving pain, improving functionality and quality of life, and developing coping strategies for the patients.[6-8] FBSS treatment modalities have traditionally been categorized as conservative, interventional, and surgical.[9] However, it should be noted that revision surgery has been documented to have an even lower success rate than the primary surgery which declines further with each consecutive operation. Indeed, the success rate of revision surgery has been reported to be within the range of only 22 to 40% according to the evaluations at the end of the second year.[10] Discouraging results of revision surgery has led to a general consensus that surgery should not be regarded as the first-line treatment approach in FBSS treatment and rather reserved as an option when a thorough conservative treatment program fails.[7,8] Pharmacologic agents such as nonsteroidal anti-inflammatory drugs, opioid analgesics, antidepressants, gabapentin, pregabalin, and physical therapy, exercise, patient education, and psychologic counseling are the most common components of conservative treatment.[7,11] Physical therapy and exercise comprise a major portion of the conservative approach.

Transcutaneous electrical nerve stimulation (TENS) and hot-pack application has been accepted as a safe, non-invasive, and effective combination for pain relief and functional improvement in routine physical therapy programs for a long time.[12] Exercise has been shown to relieve pain, correct the posture, support stabilization, and decrease the mechanical stress on the spinal structures in the patients with back pain.[13] The role of exercise has also been assessed in FBSS yet comparative analysis of different exercise methods have not been performed. Core stabilization exercises have been suggested as an effective method for pain relief and spinal stabilization in the patients with back pain and positive results have also been reported in FBSS with core stabilization exercises.[14,15]

The purpose of our study was to investigate the effect of a combination of lumbar core stabilization exercises, TENS and hot-pack application on pain, function, and quality of life in FBSS patients.

MATERIAL AND METHODS

STUDY DESIGN

This is a prospective, randomized, single blind, pilot study. Seventy six patients who were appointed to Bursa Yüksek İhtisas Training and Research Hospital, Department of Physical Medicine and Rehabilitation with the complaint of back and/or leg pain that persisted after previous lumbar spine surgery performed 3 months to 10 years ago were included in the study according to the criteria below:

1. Male or female of 18 to 65 years of age,

2. History of previous lumbar spine surgery 3 months to 10 years ago,

3. Persistence of pain 3 months postsurgery [measured as greater than 3 according to the visual analogue scale (VAS)].

4. No history of either physical therapy or epidural injection in the past 3 months.

The patients who had any one of the following conditions were not included:

1. Presence of stabilization material used in the surgery,

2. Evidence of compression fracture,

3. Comorbid conditions in which exercise is contraindicated (cardiac, respiratory, stroke),

4. Malignity, infection, pregnancy, cardiac pacemaker, and history of a chronic inflammatory disease such as ankylosing spondylitis.

The purpose and nature of the study was explained to all patients and their informed consents were obtained in accordance with the requirements of ethical standards (Helsinki Declaration). Approval for the study was obtained from the Ethics Committee of Bursa Yüksek İhtisas Training and Research Hospital with the decision number 2015/13-01 on 01.07.2015.

RANDOMIZATION AND INTERVENTIONS

The patients were randomly assigned to 2 groups of 25 each by using random number table.

Group 1 [physical therapy (TENS+Hot-pack) with exercise]: TENS (BTL-4000 Smart, 2014, United Kingdom) and hot-pack (MEDSIS MD-directive-93/42/EEC) were applied over the lumbar region 5 days a week for 4 weeks, for a total of 20 sessions. For TENS application, the electrodes were placed on bilateral paravertebral locations while the patients were in prone position. The frequency was set at 40-150 Hz with 50-100 microsecond pulse. The amplitude was increased within a range of 10-30 miliampers until the patient felt discomfort and the application proceeded slightly below that level for 20 minutes. Hot-pack was applied over the lumbar area for 20 minutes immediately after TENS. The patients in this group also performed lumbar stabilization exercises for 20 minutes after the physical therapy sessions. Before beginning each exercise session, the patients had a warm up interval that included the cat and camel stretches and aerobic exercises for ten minutes. The core stabilization exercises then proceeded with recognition of the neutral spine position (midrange between lumbar flexion and extension). Painless and balanced neutral spine position specific to each patient was determined by using abdominal muscles with anterior and posterior pelvic motion. Next, they performed exercises defined by McGill for neutral spine position stabilization. These exercises included curl-up (Figure 1), side bridge (side blank)

FIGURE 1: Curl up exercise.

FIGURE 2: Side bridge exercise.

FIGURE 3: Quadruped position exercise.

(Figure 2) and quadruped position with alternate arm/leg raises (Figure 3). The prone blank (Figure 4) and bridging (Figure 5) were also added at this stage. Each exercise position was continued for 5-10 seconds and applied in 10 repeats.[16] Compliance of the patients with the exercise program was inquired every time they had TENS and hot-pack application in the clinic. After the end of 20 sessions, the patients continued the exercises as a home program. They were called once a week and questioned whether they implemented the home program.

Group 2 (control group): The patients received none of the above therapy or exercise program and

FIGURE 4: Prone blank exercise.

FIGURE 5: Bridging exercise.

were included in the wait list to be given a physical therapy program at the end of the study period.

The patients in both groups were allowed to take paracetamol at a dose of up to 2,000 mg on demand for pain and to continue pregabalin and/or gabapentin treatment if they have started these drugs within 6 months before the study. All other analgesics or antiinflammatory agents were discontinued throughout the study period.

All patients were evaluated before, 4 and 12 weeks after the start of the study by a researcher who was blind to the group of the patient.

EVALUATION PARAMETERS

Visual Analogue Scale: Back pain at rest and during motion were separately inquired by asking the patients to score their pain from 0 (no pain) to 10 (very severe pain) according to the VAS.[17]

Oswestry Disability Index: Oswestry Disability Index (ODI) has 10 items inquiring daily life activities: Pain severity, personal care, lifting objects, walking, sitting, standing up, sleep, social life, travel, and variability of pain severity. Each item has 6 reply choices with a score range of 0 to 5. The patients are asked to pick the one that describes their condition best. According to the total score calculation, functional restriction is interpreted as mild between 0 and 14, moderate between 15 and 29, and severe over 30.[18] The reliability of Turkish version of ODI has previously been reported.[19]

Short Form-36: Short Form-36 (SF-36) scale designed by Ware et al. evaluates the effects of the disease on quality of life. The scale is not specific to any disease or treatment group. It consists of 36 items and includes eight health concepts: pain, physical function, vitality/energy, social function, disabilities caused by mental health, vitality/energy, social function, disabilities caused by physical problems (physical role) and emotional problems (emotional role), and general health. Questions were coded for each health concept. Score distribution was determined between 0 (worst) and 100 (best).[20] The Turkish version of the survey was used in the study.[21]

STATISTICAL ANALYSIS

An IBM SPSS 22.0 Statistics, USA software was used to analyze data obtained through the study. Shapiro-Wilk test was used to assess whether or not the data were normally distributed. Quantitative data were expressed as mean±standard deviation (SD), range (maximum-minimum) and median range (maximum-minimum); whereas categorical data were expressed by n (number) and percent (%). In assessment of the data, chi-square (χ^2) test was used to compare categorical data. Student's t-test was used to analyze normally distributed data and Wilcoxon signed rank test was used for intragroup comparisons. Mann-Whitney U test was used for intergroup comparisons to analyze non-normally distributed data. Calculated probability (p) values less than χ^2=0.05 were considered as significant and indicated the presence of intergroup differences while p values more than 0.05 indicated that intergroup differences were not significant.

RESULTS

Two patients from each group abandoned the study; one due to increase in his complaints in the early stage and the other one due to relocation in Group 1, and one due to spinal revision surgery performed during the study and the other one due to private reasons in Group 2. Thus, evaluations were performed on 23 patients from each group, for a total of 46 patients (Figure 6).

There was no significant difference between the groups with respect to general demographics, duration of the complaints, number and type of previous surgical operations, and the amount of time after surgery (p>0.05) (Table 1).

Statistical analysis of resting and motion pain VAS, ODI and SF-36 parameters before treatment did not show a significant difference between the 2 groups (Table 2).

In Group 1, significant improvement in resting and motion pain VAS and ODI was observed at both 4 and 12 weeks compared to before treatment (Table 3). As for the subparameters of SF-36, the improvement observed in this group was significant for all but emotional role, mental health, and mental component score at 4 weeks and for all but general health perception, emotional role, mental health, and mental component score at 12 weeks, compared to before treatment (Table 3).

In Group 2, motion but not resting VAS showed a significant improvement at 4 weeks and no significant improvement for either VAS component was observed at 12 weeks, compared to before treatment (Table 4). ODI scores in this group showed no difference at 4 weeks and they were significantly worse at 12 weeks, compared to before treatment.

As for the SF-36 subparameters in Group 2, a significant improvement was observed in pysical role, pain, and physical component at 4 weeks and only in physical component at 12 weeks, compared to before treatment (Table 4).

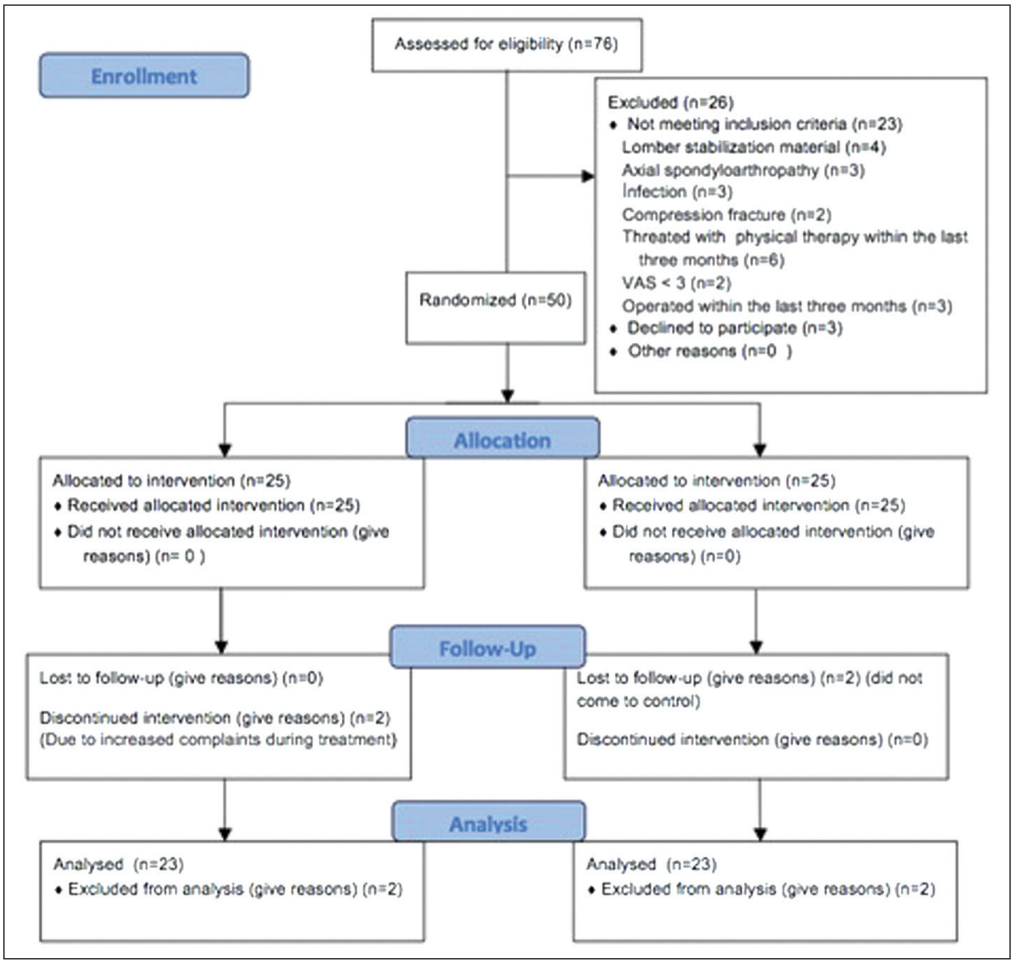

FIGURE 6: Study recruitment flow chart.

TABLE 1: Statistical comparison of the demographic data in the 2 groups.

	Group 1 (n=23)	Group 2 (n=23)	p value
Age	47.8±11.4	46.69±8.54	0.706
Gender (female/male)	15 (65%)/8 (35%)	16 (70%)/7 (30%)	0.753
Duration of complaints (months)	59.2 (3-240)	53.3 (3-240)	0.627
Time after surgery (months)	41.1 (3-120)	34.1 (3-108)	0.336
Number of surgery (once/twice)	21 (92%)/2 (8%)	20 (87%)/3 (13%)	0.639
Type of surgery			0.209
Not available	10 (44%)	12 (52%)	
Discectomy	8 (35%)	9 (40%)	
Laminectomy	4 (17%)	-	
Discectomy+laminectomy	1 (4%)	2 (8%)	

The values in the table are given as mean±standard deviation or median and minimum-maximum depending whether they have normal distribution.

TABLE 2: Statistical analysis of resting and motion pain VAS, ODI, and SF-36 parameters before treatment in the 2 groups.

	Group 1 (n=23)	Group 2 (n=23)	p value
Pain (VAS)			
Resting	5.17 (3-8)	4.95 (3-7)	0.452
Motion	8.6 (7-10)	8.30 (5-10)	0.90
ODI	45.5 (30-66)	42.08 (10-70)	0.613
SF-36			
Physical function	32.6 (21.5-46.7)	30.9 (17.3-55)	0.440
Physical role	32.5 (28-56.2)	32.6 (28-56.2)	0.615
Pain	29.6 (19.9-46.5)	31.4 (24.2-46.5)	0.489
General health	36.5 (19.5-55.6)	39.4 (17.2-57.9)	0.373
Energy-vitality	41.5 (25.4-60.9)	39.8 (23-68)	0.366
Social function	39.9 (13.7-57.1)	39.1 (13.7-57.1)	0.973
Emotional role	46.6 (23.7-55.3)	39.4 (23.7-55.3)	0.103
Mental health	44.9 (27.7-64.1)	37.9 (11.8-64.1)	0.129
Physical component score	25.7 (10.5-44.3)	29 (17.4-48.5)	0.163
Mental component score	50.3 (22.7-68.1)	43.7 (18.8-71.8)	0.138

The values in the table are given as mean±standard deviation or median and minimum-maximum depending on whether they have normal distribution; VAS: Visual analog scale; ODI: Oswestry Disabilite Index; SF-36: Short Form-36.

Comparison of the 2 groups showed significantly better improvement in Group 1 for the parameters of pain and ODI both at 4 and 12 weeks. As for the SF-36 subparameters; improvement was superior in Group 1 for all but physical role, social functionality, emotional role, and mental health at 4 weeks, and for all but emotional role, mental health, and mental component at 12 weeks (Table 5).

DISCUSSION

The results of our study have shown the positive effects of physical therapy and core stabilization exercises program on pain, functional status, and quality of life of the patients with FBSS.

Exercise has been suggested as an effective treatment modality in chronic back pain and also included in conservative treatment options for post-surgical back pain.[15,22-26]

Häkkinen et al. compared the effects of conventional versus combined stretching and strengthening home exercises in the postoperative patients with lumbar disc hernia and found improvement for pain and functional status in both exercise groups at the end of the second month, which, however, subsided

TABLE 3: Comparison of VAS, ODI and SF-36 before and 4 and 12 weeks after the start of the study in Group 1.

	BT	4th week	12th week	p (BT-4th week)	p (BT-12th week)
VAS					
Resting	5.17 (3-8)	1.6 (0-5)	2.04 (0-10)	**<0.001**	**0.001**
Motion	8.6 (7-10)	3.6 (0-10)	4.04 (0-10)	**<0.001**	**<0.001**
ODI	45.5 (30-66)	23.4 (0-62)	28.2 (0-80)	**<0.001**	**0.004**
SF-36					
Physical function	32.6 (21.5-46.7)	41.8 (21.5-57.1)	41 (17.3-57.1)	**<0.001**	**0.001**
Physical role	32.5 (28-56.2)	44.5 (28-56.2)	46.3 (28-56.2)	**0.006**	**0.001**
Pain	29.6 (19.9-46.5)	47.2 (28.9-62.7)	46.4 (19.9-62.7)	**<0.001**	**<0.001**
General health	36.5 (19.9-55.6)	46.4 (26.5-60.3)	41.8 (24.2-60.3)	**0.003**	**0.181**
Energy-vitality	41.5 (25.4-60.9)	52.1 (25.4-68)	50.1 (25.4-68)	**0.001**	**0.002**
Social function	39.9 (13.7-57.1)	49.3 (24.6-57.1)	52.3 (24.6-57.1)	**0.020**	**0.001**
Emotional role	46.6 (23.7-55.3)	51.6 (23.7-55.3)	49.3 (34.3-55.3)	0.159	0.342
Mental health	44.9 (27.7-64.1)	50.8 (36.8-64.1)	47 (30-64.1)	0.071	0.614
Pyhsical component score	25.7 (10.5-44.3)	40.3 (24.4-55.7)	40.3 (16.6-56.8)	**<0.001**	**<0.001**
Mental component score	50.3 (22.7-68.1)	54.8 (34.3-64.2)	52.4 (37.2-63)	0.176	0.475

The values in the table are given as mean±standard deviation or median and minimum-maximum depending on whether they have normal distribution. Bold values indicate significant p<0.05; VAS: Visual analog scale; ODI: Oswestry Disabilite Index; SF-36: Short Form-36; BT: Before treatment.

by the end of the 12th month.[15] In another study performed with 53 postsurgical patients with lumbar disc hernia, a significant pain relief and improvement in daily life activities was observed both at 6 and 12 months with the exercise program of abdominal, lumbar, and lower extremity muscle strenthening employed for 8 weeks.[24] In our study, unlike these studies, physical therapy (TENS, hot-pack) and exercise were applied together, considering that it would facilitate exercise, and it was found to be effective on pain, functional status and quality of life.

While several exercise programs have been used for treatment of chronic back pain, there is not yet enough evidence to show superiority of a particular protocol.[27] Strict supervision, individualization, and involvement of stretching and strengthening have been suggested as general principles for employment of such programs.[28] Dynamic lumbar stabilization exercises have recently gained more popularity in chronic back pain and conservative lumbar disc hernia treatment or postsurgical rehabilitation as well because of their positive effect on spinal stability and pain relief.[14,29] Stabilization of the spine during daily activities is known to minimize recurrent microtrauma and reduce the mechanic stress on the lumbosacral movement segment.[30-32]

In a study performed with patients who were diagnosed to have FBSS following microdiscectomy, dynamic lumbar stabilization exercise program was found to be superior to home exercise for VAS and ODI.[33] In another study in FBSS patients where 3 different exercise programs were compared, dynamic

TABLE 4: Comparison of VAS, ODI and SF-36 before and 4 and 12 weeks after the start of the study in Group 2.

	BT	4th week	12th week	p (BT-4th week)	p (BT-12th week)
VAS					
Resting	4.95 (3-7)	4.9 (0-10)	5.4 (0-10)	0.896	0.335
Motion	8.30 (5-10)	7.4 (0-10)	7.3 (0-10)	**0.020**	0.091
ODI	42.08 (10-70)	45.7 (4-86)	50 (14-96)	0.268	**0.032**
SF-36					
Physical function	30.9 (17.3-55)	33.1 (15.2-57.1)	32.9 (15.2-57.1)	0.294	0.266
Physical role	32.6 (28-56.2)	37.5 (28-56.2)	37.8 (28-56.2)	**0.039**	0.061
Pain	31.4 (24.2-46.5)	35.9 (19.9-55.9)	34.4 (19.9-51.6)	**0.022**	0.132
General health	39.4 (17.2-57.9)	37.3 (17.2-55.6)	35.9 (17.2-53.2)	0.239	0.051
Energy-vitality	39.8 (23-68)	37.8 (23-68)	40.3 (23-68)	0.371	0.955
Social function	39.1 (13.7-57.1)	39.1 (13.7-57.1)	38 (13.7-57.1)	0.806	0.754
Emotional role	39.4 (23.7-55.3)	34.7 (23.7-55.3)	34.7 (23.7-55.3)	0.205	0.295
Mental health	37.9 (11.8-64.1)	35.9 (7.3-64.1)	33.7 (7.3-59.5)	0.586	0.104
Physical component score	29 (17.4-48.5)	33.9 (11.5-54)	33.7 (17.9-54)	**0.016**	**0.014**
Mental component score	43.7 (18.8-71.8)	38.6 (12.6-64.6)	38 (13.2-62.1)	0.108	0.069

The values in the table are given as mean±standard deviation or median and minimum-maximum depending on whether they have normal distribution. Bold values indicate significant $p<0.05$; VAS: Visual analog scale; ODI: Oswestry Disabilite Index; RMDQ: Rolland Morris Disability Questionaire; SF-36: Short Form-36; BT: Before treatment.

lumbar stabilization and isokinetic exercise were found to be superior to home exercise and the control group for all parameters assessed.[34] We attribute the positive results obtained with lumbar stabilization exercises in our study to correction of reduced spinal stability. Derangement of spinal stability is believed to be due to deconditioning of FBSS patients leading to the weakness of muscles such as paraspinal and transverse abdominal.[35]

TENS is a non-invasive and safe treatment method used to relieve pain in several musculokeletal problems and has been suggested as a rehabilitation modality in a guideline prepared for chronic back pain treatment.[12,36,37] In the single study in the literature investigating the effect of TENS in FBSS, Shokrzadeh et al. employed conventional TENS (40-150 Hertz; 50-100 microseconds) and reported success rates of 17% and 22.8%, at 2 and 48 hours, respectively, in pain relief according to VAS.[38] In our study, the effect of TENS on resting and motion pain has been investigated in the much longer period and VAS measurements have shown that the positive results obtained immediately were maintained at the end of the third month.

Hot-pack application is an effective supplementary agent in back pain. It provides superficial heat which is known to reduce joint stiffness and muscle spasm by increasing collagen elasticity and local blood flow as well as to decrease pain by raising the pain threshold through its direct effect on nerve fibers and endings.[39-41] Mayer et al. found superior pain relief and functional improvement with a combination of exercise and superficial heat wrap therapy versus

TABLE 5: Comparison of the difference scores obtained for VAS, ODI and SF-36 at 4 and 12 weeks in the 2 groups.

		BT-4th week	BT-12th week	p (BT-4th week)	p (BT-12th week)
Resting VAS	Group 1	-3.56 (-8-0)	-4 (-8-5)	**<0.001**	**<0.001**
	Group 2	0 (-4-5)	0 (-5-5)		
Motion VAS	Group 1	-5 (-10-0)	-4.56 (-10-2)	**<0.001**	**0.001**
	Group 2	-0.86 (-5-2)	-0.95 (-10-3)		
ODI	Group 1	-22.8 (-60-14)	-17.3 (-60-32)	**<0.001**	**0.001**
	Group 2	3.65 (-34-36)	8 (-34-36)		
SF-36					
Physical function	Group 1	9.2 (-4.2-23.1)	8.38 (-10.5-25.2)	**0.006**	**0.011**
	Group 2	2.24 (-16.8-23.1)	2.09 (-12.6-18.9)		
Physical role	Group 1	11.96 (-28.2-28.2)	13.7 (-21.2-28.2)	0.136	**0.033**
	Group 2	4.90 (0-28.2)	5.2 (-28.2-28.2)		
Pain	Group 1	17.6 (-4.7-42.8)	16.75 (-8.5-42.8)	**0.003**	**0.003**
	Group 2	4.59 (-17.6-21.8)	3.08 (-17.6-21.8)		
General health	Group 1	9.92 (-18.8-36.1)	5.37 (-16.4-40.8)	**0.001**	**0.037**
	Group 2	-2.10 (-29-17.3)	-3.46 (-18.7-16.4)		
Energy-vitality	Group 1	10.6 (-11.8-40.2)	8.64 (-4.8-40.2)	**0.001**	**0.007**
	Group 2	-1.94 (-21.3-23.7)	0.52 (-16.6-23.7)		
Social function	Group1	9.43(-21.7-43.4)	12.49 (-16.3-32.5)	0.111	**0.003**
	Group 2	0.056 (-27.1-38)	0.056 (-27.1-38)		
Emotional role	Group 1	5.04 (-31.6-31.6)	2.76 (-21-31.6)	0.158	0.195
	Group 2	-4.7 (-31.6-31.6)	-4.69 (-31.6-31.6)		
Mental health	Group 1	5.91 (-11.4-25)	2.16 (-15.9-25)	0.073	0.084
	Group 2	-1.99 (-27.3-22.7)	-4.16 (-26.9-27.3)		
Physical component score	Group 1	14.66 (-5.3-35.9)	14.65 (-11.3-36.1)	**0.007**	**0.007**
	Group 2	4.9 (-11.8-27.1)	4.65 (-8.4-21.8)		
Mental komponent score	Group 1	4.44 (-16.4-31.6)	2.13 (-17.8-26.8)	**0.031**	0.06
	Group 2	-5.06 (-34.2-18.8)	-5.65 (-27.7-28,6)		

The values in the table are given as mean±standard deviation or median and minimum-maximum depending on whether they have normal distribution. Bold values indicate significant $p<0.05$; BT: Before treatment; VAS: Visual analog scale; ODI: Oswestry Disabilite Index; SF-36: Short Form-36.

exercise alone or control group in back pain.[40] In our study, TENS was also applied together with the hot-pack before the exercise. Similarly, it was found to be effective on pain and functional status. In another study where the effects of superficial heat on the paraspinal muscular activity and psychological status of the patients with chronic pain were investigated, the authors observed pain relief, reduced anxiety related to pain, decreased electromyographic (EMG) muscular activity, and improved functionality according to the parameters of VAS, EMG, Roland Morris Disability Index and anxiety symptom scale-20.[42] In our study, we found a significant improvement in the treatment group in VAS and ODI.

Pain and functional restriction inevitably create a negative impact on the quality of life of the patients with chronic back pain. We used SF-36, which is a much frequently used inquiry to assess this aspect of back pain, to observe how FBSS changed the quality of life of the patients. The results obtained both at 4 and 12 weeks in our study have shown a significant improvement in the treatment group for all SF-36 subparameters but emotional role, mental health, and mental component compared to before treatment, and for all SF-36 subparameters but physical role, social functionality, emotional role, and mental health compared to the control group.[43-45] The unexpected improvement observed in the control group at for motion VAS and SF-36 subparameters of physical role, pain, and physical component can be explained as a positive result of the relationship between the patient and physicians throughout the study period.

While the relatively low number of the patients and the lack of much longer follow-up evaluations should be noted as the shortcomings of our study, we may suggest our findings as a valuable contribution to the ongoing research since it is the first clinical study comparing the efficiency of physical therapy and core stabilization exercises versus no-intervention in FBSS patient.

CONCLUSION

The results of our study showed that physical therapy and core stabilization exercises have positive effects on pain, functional status and quality of life in patients with BBCS.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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