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The Effect of Short-Wave Diathermy and Exercise on Depressive Affect in Chronic Low Back Pain Patients

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ABSTRACT

Objective: The aim of this study was to compare exercise, continuous short-wave diathermy (SWD) and intermittent SWD treatment modalities and to evaluate the effects of these treatments on chronic back pain and depression. **Methods:** This study is an intervention trial which evaluated patients who applied to our clinic due to chronic low back pain between 2008-2009. The study group consisted of 90 patients between the ages of 40-65 who had had low back pain for more than 6 months. The patients were randomized into three groups. The first group received placebo short-wave diathermy, the second group received continuous short-wave diathermy, and the third group received pulsed short-wave diathermy. Pain was evaluated by Visual Analog Scale (VAS) and the Pain Disability Index (PDI).The Modified Oswestry Low Back Pain Disability Questionnaire Form was used for the measurement of functional deficiency and the Beck Depression Inventory (BDI) was used for the evaluation of depression.All scales were performed before the treatment, immediately after treatment and 3 months after treatment. **Results:** Significant decreases in PDI and VAS scores were found in all groups ($p<0.05$ for each). Similarly, there was a significant improvement in all groups in terms of functional deficiency($p<0.001$ for each), while no differences were found between groups ($p = 0.895$). In terms of BDI scores, there was no improvement in those receiving only exercise, while Group 2 and 3 had significant improvements ($p <0.05$). When groups were compared for BDI scores, no differences were found between any of the groups ($p = 0.189$). **Conclusion:** Continuous SWD treatment with exercise was found to be more effective in reducing pain in patients with chronic low back pain than other treatment modalities used in our study**.** Although there was no significant difference between the groups in terms of depressive mood, it was found that those receiving continuous and pulsed SWD treatment had significant improvements in depression as measured by the BDI.

Keywords: Chronic Low Back Pain Patients, Short-Wave Diathermy, Exercise on Depressive Affect.

1. BACKGROUND

Low back pain is a common health problem that is responsible for serious morbidity.Recent research suggests that low back pain causes more disability-adjusted life years than any other health condition (1).

Chronic low back pain, which is a common condition, is also associated with physical disability and depressive mood (2). It has also been shown that mild depression is seen in approximately 15% of patients with low back pain (3, 4). Depending on the frequency and severity of low back pain symptoms, patients may experience conditions such as mild depression, depressed mood with mild functional impairment, loss of interest and low energy (5). The presence of mild depression at the onset of low back pain was accepted as an indication of the chronic progression of pain (6-8). In a comprehensive review, it was been reported that, psychological variables actually have more effect on back pain than medical and biomechanical factors (8).

Both continuous and pulsed shortwave SWD have been used for some time in the treatment of pain under a number of conditions (9).Although it is generally accepted that the temperature increaseobtained with SWD will cause significant ameliorating effects in tissues, several studies have focused on elucidating the efficacy of SWD with other therapeutic approaches in chronic low back pain.It has been suggested that pulsed SWD application increases circulation in tissues without excessively increasing temperature, and is therefore believed to be advantageous.However, there is insufficient evidence for the efficacy of pulsed SWD, and available results of various studies are

unclear as to the degree of improvement obtained with SWD in cases of chronic low back pain.It has also been reported that systematic evaluations of different therapeutic approaches and protocols for the use of SWD are required in order to optimize treatments (9).

2. OBJECTIVE

Therefore, the aim of our study was to compare exercise, continuous SWD, and pulsed SWD treatment modalities in patients with chronic low back pain, and to evaluate the effects of these treatments on depression and chronic low back pain.

3. MATERIALS AND METHODS

This study was planned as an intervention trial that evaluated patients who applied to our clinic due to chronic low back pain between 2008-2009. The study group was comprised of 90 patients with back pain that exceeded 6 months' duration.The study was approved by the Clinical and Laboratory Research Ethics Committee.

Inclusion criteria:

-Being aged between 40–65 years.

-Having back pain for more than 6 months without spread to regions other than the lumbar, sacral and lumbosacral regions.

- Being able to comply to the outpatient program.

- Agreeing to participate in the study.

Exclusion criteria

- Having any type of neurological deficit (motor, sensory and reflex).

-Requiring any type of urgent intervention(s) due to low back pain.

- Having a history of cardiovascular disease which would prevent exercise.

- Having radicular pain.

-Being pregnant.

-Having severe osteoporosis or osteomalacia.

- Uncontrolled DM, hypertension.

-Having any infectious disease, rheumatic disease or history of malignancy.

- Having any condition preventing the use ofSWD therapy.

- Spondylolisthesis or history of back surgery.

-Having received electrotherapy program within the last six months

The patients were randomly selected and divided into three groups, each comprised of 30 patients. All three groups were given an exercise program. In the first group, placebo shortwave diathermy was applied while the device was closed. The second group received continuous shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watts), while the third group received pulsed shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watt, 0.3 ms pause). All scales and measurements were performed 3 times in all patients: at study initiation (before-treatment scores), as soon as treatment was completed (after-treatment scores) and 3 months after final treatment (3rd month scores).

Exercise programs were explained to the patients in the clinic and the first set was performed under the supervision of a physician. They were asked to perform the given exercise routine 3 times a day (each one comprised of 10 sets of the routine), and to record their exercise into an exercise diary each day.Short-wave diathermy treatment was performed for 20 minutes each week-day, for a total of 15 sessions during 3 weeks.

Parameters Used

1- Pain: It wasevaluatedby Visual Analogue Scale (VAS). The patients were given a 10-cm horizontal paper numbered from 1 to 10 and were told to grade their pain in consideration that '0' meant no pain while '10' meant the most severe pain they had suffered in their life.Additionally, patients completed the 'Pain Disability Index' questionnaire in order to determine how much of an effect their pain had on their daily life.

2- Functional Deficiency Measurement: The Modified Oswestry Low Back Pain Disability Form was used for this purpose.This scale is recommended as a precision scale in the measurement of functional disability in patients with low back pain due to its value and repeatability. The Turkish-language validity and reliability of the form was performed by Yakut et al. (10). There are 10 questions in the form, each of these questions are answered by choosing one of 6 choices scored from 0 to 5 points. The patient is asked for to select the expression that best describes his/her condition.The highest possible score is 50. The patient is considered to have mild functional disability with a score between 1-10 points, moderate functional disability between 11-30 points and severe functional disability between 31-50 points (10,11).

3- Depression Measurement: The Beck Depression Scale was used for this purpose. This scale, has been shown to an accurate measure of depression level (12). The Turkish-language validity and reliability study of the scale was performed by Hisli et al. The scale is comprised of 21 questions, each with 4 choices which correspond to 0–3 points, and the patient is asked to choose the appropriate sentence considering his/her condition in the last week.The highest possible score is 63. A total score between 0-9 points indicates no depression, 10 to 18 points indicates mild depression, 19 to 29 points indicates moderate depression and >30 points indicates severe depression (12, 13).

Statistical Analysis

All analyses were performed on SPSS v21. The Shapiro Wilk test was used for normality check. Comparisons between groups were made with one-way Analysis of Variances (ANOVA) or Kruskal Wallis test regarding normality for continuous variables, while Chi Square tests were used for categorical variables. Within group evaluation of repeated measurements were made with the Friedman's test and the differences between repeated measurements were calculated, these differences were then compared with Kruskal Wallis test to evaluate the differences between groups. For pairwise comparisons theBonferroni correction method was used. $P<0.05$ values were accepted as statistically significant.

4. RESULTS

We included 90 patients (17 males and 73 females) into our study, mean age was 51.36 ± 6.07 years. We divided these patients into three groups according to treatment. There was no significant difference between our groups regarding age, body mass index (BMI), education status, working status, symptom duration, diagnosis with magnetic resonance imaging, paracetamol intake and number of days of exercise. Males were more frequent in the Group 3 than other groups (p=0.044) (Table 1).

	Group 1	Group 2	Group 3	p
N	30	30	30	N.A
Age	51.47 ± 6.50	51.63 ± 6.26	50.97 ± 5.59	0.908
Gender (Male)	3 (10.00%) [a]	4 (13.33%) [a]	10 (33.33%) [b]	0.044
BMI	25.35 ± 3.82	25.42 ± 3.66	25.07 ± 3.26	0.924
Education Status				
Primary	8 (26.67%)	6 (20.00%)	9 (30.00%)	0.794
Secondary	6 (20.00%)	9 (30.00%)	6 (20.00%)	
High	10 (33.33%)	12 (40.00%)	9 (30.00%)	
University	6 (20.00%)	3 (10.00%)	6 (20.00%)	
Working Status				
On Foot	10 (33.33%)	10 (33.33%)	5 (16.67%)	0.257
Housewife	16 (53.33%)	15 (50.00%)	15 (50.00%)	
On Chair	4 (13.33%)	5 (16.67%)	10 (33.33%)	
Symptom Duration (year)	5 (0.5 - 20)	3.5 (1 - 17)	2.25 (0.5 - 30)	0.185
Diagnosis				
Bulging	5 (16.67%)	9 (30.00%)	6 (20.00%)	0.615
Protrusion	9 (30.00%)	9 (30.00%)	14 (46.67%)	
Extrusion	3 (10.00%)	2 (6.67%)	2 (6.67%)	
Spinal Stenosis	1 (3.33%)	2 (6.67%)	0 (0.00%)	
Degeneration	12 (40.00%)	8 (26.67%)	8 (26.67%)	
Paracetamol Intake	0 (0 - 23)	0 (0 - 30)	0 (0 - 9)	0.294
Exercise (Day)	89.5 (10 - 90)	75 (2 - 90)	70 (12 - 90)	0.976

Data given as mean ± standard deviation or median (minimum - maximum) for continuous variables regarding normality and frequency (percentage) for categorical variables. Same letters denote lack of significant difference between groups

Table 1. Summary of Patients' Characteristics Regarding Treatment Groups

When we evaluated Pain Disability Index (PDI) (Figure 1), after-treatment and 3rd month scores were significantly lower than before-treatment scores for Group 1 (p<0.001). After-treatment scores were significantly lower than before treatment scores for Group 2 (p=0.020), also 3rd month scores were significantly lower than after-treatment scores (p<0.001). In Group 3, after-treatment scores were found to be significantly lower than before-treatment scores (p<0.001), also 3rd month scores were significantly lower than after-treatment scores (p=0.017). The decrease in PDI score was significantly higher in Group 2 and 3 compared to Group 1 (p=0.039) (Table 2).

When we evaluated VAS scores (Figure 2), after-treatment and 3rd month scores were significantly lower than before-treatment scores for Group 1 (p<0.001). In Group 2, after-treatment scores were significantly lower than before-treatment scores for Group 2 (p<0.001), also 3rd month scores were significantly lower than after-treatment scores (p=0.029). In Group 3, after-treatment scores and 3rd month scores were significantly lower than before-treatment scores (p<0.001). Decrease in VAS scores were significantly higher for Group 2 than Group 1 (p=0.011) (Table 2).

When we evaluated Modified Oswestry Low Back Pain Disability Questionnaire scores, after-treatment and 3rd month scores were significantly lower than before-treatment scores for Group 1 (p<0.001). In Group 2, after-treatment and 3rd month scores were significantly lower than before-treatment scores (p<0.001). In Group 3, after-treatment and 3rd month scores were significantly lower than before-treatment scores (p<0.001). There was no significant difference between groups regarding decrease in Modified Oswestry Low Back Pain Disability Questionnaire scores (p=0.895) (Table 2).

When we evaluated Beck Depression Inventory (BDI) scores, Group 1 showed no significant differences (p<0.781). Third month scores were significantly lower than before-treatment scores for Group 2 (p<0.016). In Group 3, after-treatment and 3rd month scores were significantly lower than before-treatment scores (p=0.005). Finally, there was no significant difference between groups regarding the decreases in BDI scores (p=0.189) (Table 2).

5. DISCUSSION

In our study, 3 different treatment modalities (exercise therapy only, exercise combined with continuous SWD, and exercise combined with intermittent SWD) were compared in terms of pain, functional deficiency and depression.

While PDI and VAS were used for pain assessment in our study, the Modified Oswestry Low Back Pain Disability Form was used for measurement of functional impairment. According to the Modified Oswestry Disability Form, there was a significant decrease in all groups when before- and after-treatment results were compared. But there was no difference between the groups. Similar to our study, a study comparing SWD with yoga and SWD combined with exercise showed a significant improvement in both groups according to Modified Oswestry Discrimination Form (14). In our study, there was a significant decrease in PDI and VAS scores and pain perception in all three groups. The PDI and VAS scores were both found to be significantly decreased with treatment (before vs after-treatment scores), but there was

		Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)	p (Between Groups)
Pain Disability Index	Before	31 (16 - 61) [a]	30.5 (18 - 60) [a]	31 (13 - 46) [a]	0.039 (1)
	After	17 (0 - 45) [b]	17.5 (3 - 44) [b]	16.5 (0 - 30) [b]	
	3rd Month	14.5 (0 - 32) [b]	7 (0 - 24) [c]	7 (0 - 27) [c]	
p (Within Groups)		<0.001	<0.001	<0.001	
VAS	Before	7 (3 - 9) [a]	7 (5 - 10) [a]	6.5 (3 - 9) [a]	0.011 (2)
	After	3 (0 - 6) [b]	3 (0 - 5) [b]	3 (0 - 5) [b]	
	3rd Month	3 (0 - 5) [b]	1 (0 - 4) [c]	1 (0 - 5) [b]	
p (Within Groups)		<0.001	<0.001	<0.001	
Modified Oswestry Low Back Pain Disability Questionnaire	Before	24.5 (7 - 40) [a]	21.5 (11 - 35) [a]	21.5 (12 - 38) [a]	0.895
	After	17 (3 - 30) [b]	13.5 (3 - 25) [b]	12.5 (4 - 33) [b]	
	3rd Month	13.5 (2 - 28) [b]	11 (0 - 24) [b]	9 (3 - 30) [b]	
p (Within Groups)		<0.001	<0.001	<0.001	
Beck Depression Inventory	Before	10.5 (1 - 22)	9 (0 - 27) [a]	9.5 (2 - 38) [a]	0.189
	After	10 (2 - 22)	7 (0 - 18) [ab]	7 (2 - 21) [b]	
	3rd Month	10 (0 - 25)	5 (0 - 20) [b]	8.5 (1 - 25) [b]	
p (Within Groups)		0.781	0.016	0.005	
Data given as median (minimum - maximum)					
Same letters denote lack of significant difference between repeated measurements.					
(1) No significant difference between Group 2 and Group 3.					
(2) Significant difference is only between Group 1 and Group 2.					

Table 2. Summary of Scores Regarding Treatment Groups and Comparison Results

no significant difference between after-treatment and third month results.However, in groups 2 and 3 (who received exercise in combination with continuous SWD or pulsed SWD), there was a decrease pain perception after treatment and at the third month. This finding suggests that SWD application is more effective when combined with exercise (and vice-versa) in the reduction of pain. Intergroup evaluationsalso supported this result, which showed that the decrease in pain scores was significantly higher in Group 2 and Group 3 compared to Group 1. Although both Group 2 and Group 3 had significant reduction in VAS scores, continuous SWD therapy (Group 2) was found to be the most effective treatment in reducing pain when comparing before-treatment and 3rd month VAS scores. In contrast to our results, a similar study which also assessed pain levels according to type of SWD treatment, reported thatpulsed SWD was more effective in reducing VAS scores compared to continuous SWD (15). However, the frequency and maximum power of pulsed SWD used in this study was different from ours, which may explain the differences in findings and also underlines the requirement for a systematic evaluation of SWD treatment parameters used for low back pain. Inanother study, it was reported that there was a significant improvement in recipients of continuous SWD compared to placebo. The authors concluded that SWD treatment was an effective method in patients with chronic low back pain (16). However, they did not evaluate pulsed SWD; therefore, comparisons could not be made in this regard.

Several studies have shown that biopsychosocial factors are less important in acute low back pain, but these factors play an important role in chronic low back pain. In addition, since most patients with chronic low back pain tend to have somatization disorder, the results of psychological tests should be compared with the initial value for the same individual rather than with controls or reference data (17,18).Therefore, in our study, we evaluated the depression states of patients with chronic low back pain at the beginning of the study, immediately after treatment and three months after treatment in order to evaluate the changes in depression. In our study, there was no significant difference in the scores of the Beck Depression Inventory in Group 1 which received only exercise therapy.On the other hand, there was a significant decrease in the continuous SWD treatment group (Group 2) at the 3rd month, while there was a significant decrease in the group receiving pulsed SWD treatment (Group 3) at post-treatment and also3rd month results. Although we found significant decreases in within-group comparisons, we could not find any significant difference between the three groups in terms of Beck Depression Scale scores. In addition, in our study, we found depressive symptoms in most of our chronic low back pain patients, which was in agreement with the literature, but none of our patients had high enough values for the diagnosis of major depression. In a recent large-scale study with data from 43 different countries, it was reported that all types of depression are associated with an increased likelihood of pain (19). A study

evaluating the effect of different treatment modalities on low back pain reported that therapeutic approaches were effective in not only reducing pain but also reducing depressive mood (20).

These results suggest that pain perception and depressive feelings may show a proportional relationship in patients with chronic low back pain.Therefore, we believe that the significant improvement in Beck Depression Scores in our patients was associated with back school training, implementation of home exercises and the pain-decreasing features of SWD treatment.

One of the limitations of our study was the short-term follow-up period of the patients. A longer-term and more comprehensive study should examine the relationship between chronic low back pain and depression.In addition, the lack of objective evaluation of home exercise applications can be considered as another limitation. However, the literature on this topic(the use of SWD in patients with chronic low back pain) is rather limited and our findings may contribute to future studies, especially those that aim to determine the differences between continuous and pulsed SWD and the parameters used in therapy.Further studies on the effect of SWD treatment on low back pain and other related factors such as depression will provide more detailed information about the effectiveness of the treatment.

6. CONCLUSION

As a result, there was a decrease in the perception of pain in all 3 groups. The group who received continuous SWD treatment with exercise was found to be superior to other treatment modalities in terms of reducing pain in patients with chronic low back pain. Although there was no significant difference between the groups in terms of depressive mood, there was a significant decrease in depression score in the groups receiving continuous and pulsed SWD treatments.

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