Original research article

Effectiveness Of Shortwave Diathermy Treatment On Muscle Power In Patients With Chronic Low Back Pain

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Abstract

Aims: The aim of the study to find out the effectiveness of Shortwave Diathermy Treatment on Muscle Power in Patients with Chronic Low Back Pain.

Materials and methods: This was an interventional study conducted in the Department of Physical Medicine and Rehabilitation, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 1 year. 150 patients were randomly divided into 3 groups. There were 50 patients in each group. In the first group, placebo shortwave diathermy was applied while the device was closed. Continuous shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watts) was applied in the second group, while the third group received pulsed shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watts, 0.3 ms pause). The isokinetic muscle strength measurements of patients were performed using a Cybex isokinetic system (Cybex-Norm) before and 3 months after the treatment. **Results:** Out of 150 patients 35 was males and 115 females in our study, mean age was 50.68 ± 5.89 years. Males were more frequent in the Group 3 than other groups (p=0.049).When we evaluated isometric muscle strength, flexion strength was significantly higher after treatment than before for Group 1 (p=0.001). On the other hand there was no significant difference between measurements regarding extension (p=0.352) and rotation (p=0.072) strength. There was no significant difference between before and after treatment results regarding flexion, extension and rotation muscle strength for other groups. The increase in isometric flexion strength was significantly higher for Group 1 than Group 3 (p=0.019).There was no significant difference between our groups regarding isometric extension strength (p=0.624) and isometric rotation strength (p=0.059).When we evaluated isokinetic muscle strength at 60°/sec angular speed, flexion strength (p=0.013) and extension strength (p=0.005) were significantly higher after treatment than before treatment for Group 1, while there was no significant difference between measurements regarding rotation strength (p=0.411). In Group 2, flexion strength (p=0.006) and extension strength (p=0.031) were significantly higher after treatment than before treatment, while there was no significant difference between measurements regarding rotation strength (p=0.597). In Group 3, there was no significant difference between before and after treatment results regarding flexion, extension and rotation muscle strength.

Conclusion: There are no significant differences between exercise therapy alone and exercise therapy in combination with diathermy (either continuous or pulsed) in terms of their effects on lumbar muscle strength.

Keywords: Chronic low back pain, Lumbar muscle strength, Exercise

Introduction

Low back pain is defined as an uncomfortable sensation in the lumbar and buttock region originating from neurons near or around the spinal canal that are injured or irritated by one or more pathologic processes.[1] Low back pain is a symptom complex[2] which persists for more than three months is called chronic low back pain[3] and affects the area between the lower rib

cage and gluteal folds.[4] Chronic low back pain remains poorly understood and inadequately treated due to the heterogeneity of the patients' population, and the lack of a simple and useful system.[5] Chronic low back pain is one of the most common causes of chronic disability[6] and most prevalent medical disorders in industrialized societies.[7] Frymoyer stated that, lifetime prevalence of low back pain ranges from 60%-90% and the annual incidence is 5%. Men and women are equally affected, but women suffer after the age of sixty.[8] It is estimated that 80%-90% of all people experience at least one episode of back pain in their lifetime.[9] Additionally it causes work losses, which in recent years have increased more rapidly than any other common form of incapacity. Short-wave diathermy (SWD) is the most prevalent therapy for low back pain however the effectiveness of SWD isn't better than placebo treatment. It is the therapeutic utilization of high frequency current. The greater parts of the commercially accessible diathermy machines work at a frequency of 27.33mhz at a wavelength of 11 meters. Short-wave diathermy can be connected by condenser technique or by induction coil technique. Condenser plates or condenser pads are connected to the back with spacing among skin and electrodes given by 1 to 2 inch layers of terry cloth. Acceptance coil might be connected container produces the highest temperature in the superficial musculature. In LBP when superficial muscle warming is wanted, the inductive applicators are preferred over condenser applicator, the dosimetry in swd is mellow agreeable heat seen by the patient. for the treatment of non-explicit LBP, SWD is connected to the low back region for 15-30 minutes. Additionally, shortwave diathermy treatment before performing exercise therapy has been shown to increase the range of articular motion.[10] This brings to mind that short-wave diathermy combined with exercise can have a synergistic effect. However, the number of studies evaluating this dual therapy combination and its effects on the treatment of reduced strength and function in lumbar muscles is limited. In this study, we aimed to investigate the effect of shortwave diathermy therapy combined with exercise on lumbar muscle strength.

Materials and methods

This was a interventional study conducted in the Department of Physical Medicine and Rehabilitation, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for one year.

Inclusion criteria

- Patients have CLBP for at least 6 months

Exclusion criteria

- Patients with cardiovascular disease,
- Abnormal neurologic findings
- Patients could not perform physical activity or undergo diathermy treatment

Methodology

The demographic profile of patients and the duration of lumbar pain were recorded. 150 patients were randomly divided into 3 groups. There were 50 patients in each group. In the first group, placebo shortwave diathermy was applied while the device was closed. Continuous shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watts) was applied in the second group, while the third group received pulsed shortwave diathermy (27.12 MHz frequency and 11.06 m wavelength, 200 watts, 0.3 ms pause).

The first exercise routine was performed under physician supervision and the patients were asked to perform the given exercise schedule at their home. Patients were asked to perform 3 sets of the routine 10 times a day and also to keep a record of their schedule in an exercise

diary. Shortwave diathermy treatment seances were 20 minutes long and were scheduled 5 days a week for 4 weeks (total number of seances was 20).
The isokinetic muscle strength measurements of patients were performed using a Cybex isokinetic system (Cybex-Norm) before and 3 months after the treatment. Before each test, submaximal warm-up exercise was performed. Body flexion and extension measurements were made at 60°/sec and 120°/sec angular velocities with 5 repetitions.

Statistical analysis

The recorded data was compiled entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations were calculated. Statistical test applied for the analysis was chi-square test, Independent sample t-test and Paired t-test. Level of significance was set at $p \leq 0.05$.

Results

We included 150 patients (35 males and 115 females) into our study; mean age was 50.68 ± 5.89 years. We divided them into three groups. There was no significant difference between our groups regarding age, body mass index (BMI), and education status, diagnosis of magnetic resonance, paracetamol intake and number of days of exercise. Males were more frequent in the Group 3 than other groups (p=0.049) (Table 1).

Table 1: Demographic profile of patients

Parameter	**Group 1st =50**	**Group 2nd =50**	**Group 3rd = 50**	**P value**
Age	51.47±6.50	51.63±6.50	50.97 ± 5.59	0.856
Male	6(12%)	9(18%)	20(40%)	.049
BMI	25.35±3.82	25.42±3.66	25.07 ± 3.26	0.789
Education status				0.856
Up to 8th	8(16%)	9(18%)	10(20%)	
Up to 12th	12(24%)	19(38%)	15(30%)	
Graduate and above	30(60%)	22(44%)	25(50%)	
Diagnosis				0.678
Bulging	5(10%)	11(22%)	11(22%)	
Protrusion	16(32%)	16(32%)	25(50%)	
Extrusion	4(8%)	3(6%)	2(4%)	
Spinal Stenosis	4(8%)	5(10%)	1(2%)	
Degeneration	21(42%)	15(30%)	11(22%)	

Test applied: chi-square test and Independent sample t-test

When we evaluated isometric muscle strength, flexion strength was significantly higher after treatment than before for Group 1 (p=0.001). On the other hand there was no significant difference between measurements regarding extension (p=0.352) and rotation (p=0.072) strength. There was no significant difference between before and after treatment results regarding flexion, extension and rotation muscle strength for other groups. The increase in isometric flexion strength was significantly higher for Group 1 than Group 3 (p=0.019), while there were no significant differences between Group 2 and Group 1 (p=0.811), and also Group 2 and Group 3 (p=0.158) in terms of increase. There was no significant difference between our groups regarding isometric extension strength (p=0.624) and isometric rotation strength (p=0.059) (Table 2. When we evaluated isokinetic muscle strength at 60°/sec angular speed, flexion strength (p=0.013) and extension strength (p=0.005) were significantly higher after treatment than before treatment for Group 1, while there was no significant difference between measurements regarding rotation strength (p=0.411). In Group 2, flexion strength

(p=0.006) and extension strength (p=0.031) were significantly higher after treatment than before treatment, while there was no significant difference between measurements regarding rotation strength (p=0.597). In Group 3, there was no significant difference between before and after treatment results regarding flexion, extension and rotation muscle strength. When groups were compared with each other, there were no significant differences in terms of the increases in the isokinetic flexion, extension and rotation strength at 60°/sec angular speed (Table 2) When we evaluated isokinetic muscle strength at 120°/sec angular speed, flexion strength (p=0.014) and extension strength (p=0.031) were significantly higher after treatment than before treatment for Group 1, while there was no significant difference between measurements regarding rotation strength (p=0.711). In Group 2, flexion strength (p=0.041) was significantly higher after treatment than before treatment, while there was no significant difference between measurements regarding extension strength (p=0.229) and rotation strength (p=0.468). In Group 3, there was no significant difference between before and after treatment resultsin terms of flexion, extension and rotation muscle strength. Finally, there were no significant differences between our groups regarding the amount of increase in isokinetic flexion, extension and rotation strength at 120°/sec angular speed (Table 2).

Table 2: Measurements of muscle strength regarding treatment groups and comparison result

Isometric Flexion	Before	25.5(4 - 64) a	38(10 - 108) ab	43(3 - 109) b	0.019
	After	36(10 - 111)	45(3 - 106)	47(21 - 106)	
	P (Within Groups)	0.001	0.061	0.801	
Isometric Extension	Before	56.5(20 - 91)	54(15 - 111)	57.5(19 - 168)	0.624
	After	56(29.5 - 104)	70.5(25 - 129)	65(27 - 189)	
	P (Within Groups)	0.352	0.081	0.06	
Isometric Rotation	Before	57.4(11 - 138)	72.35(22.2 - 172.3)	80.4(10.2 – 163.4)	0.059
	After	62.7(18.2 - 261.3)	80.3(18.1 - 168.4)	64.3(25.7 – 148.3)	
	P (Within Groups)	0.072	0.811	0.212	
Isokinetic Flexion (60°/sec)	Before	34.5(2.5 - 86)	41.7(4 - 132	53.1(14 - 112)	0.050
	After	39.4(1.2 - 119)	65(3 - 154)	57(5 - 151)	
	P (Within Groups)	0.013	0.006	0.924	
Isokinetic Extension (60°/sec)	Before	17(2 – 44.5)	24.5(4.1 - 53)	26(2.3 - 75)	0.824
	After	23.5(2 – 44.5)	28(6.3 - 45)	31(3.4 - 92)	
	P (Within Groups)	0.005	0.031	0.061	
Isokinetic Rotation (60°/sec)	Before	193.24(101 - 382)	213.71(51 - 748)	209.55(1.3 - 444.5)	0.511
	After	189.7(14.5 - 397)	215.26(51.3.2 - 881.5)	176.4(35.1 - 559.5)	
	P (Within Groups)	0.411	0.597	0.259	
Isokinetic Flexion (120°/sec)	Before	10(2 - 72)	12(3 - 104)	15(3 - 57)	0.522
	After	16.5(2 - 91)	18(4 - 110)	17.5(2 - 106)	

	P (Within Groups)	0.014	0.041	0.211	
Isokinetic Extension (120°/sec)	Before	6.5(2 - 40)	7.5(2 - 41)	8(3 - 21)	0.844
	After	7(4 - 85)	10(4 - 33)	8(3 - 44)	
	P (Within Groups)	0.031	0.229	0.051	
Isokinetic Rotation (120°/sec)	Before	151(60 - 725)	139.85(44.3 - 749.7)	179.4(50 - 1041)	0.461
	After	135.5(51 - 715)	133.5(80.7 - 889)	144.54(72 - 439.5)	
	P (Within Groups)	0.711	0.468	0.310	

Test applied: paired t-test and independent sample t-test

Discussion

The fact that there are more than 20 types of treatment for chronic LBP, each of which has multiple subcategories, is a testament that no single approach has yet been able to demonstrate its definitive superiority.[11] For example, exercise therapy is one promising treatment option, but there is still no consensus upon which kind is the most effective.[12] This situation makes it very challenging for Clinicians, policy makers, insurers, and patients to make decisions regarding which treatment is the most appropriate for chronic LBP. In this study, patients who received only exercise therapy (1st group), continuous diathermy with exercise (2nd group), and pulsed shortwave diathermy treatment with exercise (3rd group) were compared in terms of lumbar muscle strength. It is well known that lumbar muscle weakness results in early fatigue in patients with chronic low back pain.[13,14] In a study, the effects of exercises on lumbar extensors were investigated in patients with chronic low back pain; it was reported that exercise was beneficial and significant improvements in the strength of the back extensors were observed.[15] In a recent meta-analysis study of 39 randomized controlled clinical trials, the efficacy of exercise in patients with chronic low back pain was assessed. The study concluded that exercise programs including strength/resistance and coordination/stabilization were effective in the treatment of CLBP.[16] In our study, the only significant difference observed between the groups was in terms of isometric flexion strength which revealed that the 1st group had higher strength. Concerning isometric flexion strength, significant improvement was observed in the 1st group which received only exercise therapy compared to the 3rd group which received exercise and pulsed shortwave diathermy combined. In fact, results of the 2nd and 3rd groups were higher in terms of total muscle strength after treatment, but the initial muscle strength of the 1st group was significantly lower than the 2nd and 3rd therefore, the improvement observed in the first group was significantly higher than the other groups. Although the patient groups were similar to each other in many of the parameters, the number of male patients in the 3rd group was significantly higher than Groups 1 and 2. This may have been the cause of the difference in initial muscle strength and could have affected the results. However, as we also compared the amount of increase in each group, our results remain relevant. Nevertheless, the consistency of these results should be reassessed by a study with a larger sample size and randomization

methods to ensure a balanced distribution of men and women in groups. In a study quite similar to ours, continuous and pulsed shortwave diathermy combined with exercise were compared by the formation of 3 groups; the 1st group had continuous shortwave diathermy, the 2nd and 3rd groups received pulsed shortwave diathermy (200 Hz maximum pulse power of 300 W).[17] According to the results, the group which received pulsed shortwave diathermy treatment achieved a significant increase in muscle strength in the back extensor muscle group. Besides, it was stated that there was no difference between the 2nd group and the 3rd group in terms of muscle strength. However, the aforementioned study lacked a control group who were only given exercise treatment, and also, muscle strength was measured with a goniometer. Furthermore, in the current study, both pulsed and continuous diathermy was applied at a frequency of 27.12 MHz and at a wavelength of 11.06 m and 200 watts. For instance, Danneels et al. evaluated the effect of 3 treatment modalities on the strength of the lumbar multifidus muscle in patients with CLBP. They reported that a significant strength increase was achieved in the group receiving stability training with dynamic-static resistance.[18] However, it was stated that diathermy was applied to all 3 groups before performing exercise. Therefore, it is not possible to evaluate the effect of diathermy treatment according to the results of this study. In our study, results of isokinetic flexion at 60°/sec and 120°/sec were determined to be significantly improved in Groups 1 and 2. However, there was no significant difference between the two groups. In terms of isokinetic extension, there was a significant increase in Groups 1 and 2 at 60°/sec, while only the 1st group showed significant increase in terms of isokinetic extension at 120°/sec. In the 3rd group, no significant results were obtained in any of the evaluations. In addition, we could not detect any significant difference between the 3 groups in the results for isometric rotation and isokinetic rotation (60°/sec-120°/sec). In a study in which the effect of exercise on isokinetic muscle strength was investigated, it was reported that there was a significant increase in isokinetic extension strength, while there was no significant difference in isokinetic flexion.[19] Although this is comparable to our study in terms of exercise results, they did not evaluate diathermy therapy; therefore, comparisons with our study could not be performed.

Conclusion

We conclude that there are no significant differences between exercise therapy alone and exercise therapy in combination with diathermy (either continuous or pulsed) in terms of their effects on lumbar muscle strength.

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