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Comparison of short-wave diathermy, Transcutaneous electrical nerve stimulation of electrotherapy methods and exercise therapy in chronic low back conditions

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Abstract

Background: Low back pain is a significant contributor to global disability, impacting individuals across different age groups. Research suggests that around 80% of people will encounter low back pain at some stage in their lives. This condition is more prevalent among middle-aged and elderly individuals, with a higher occurrence among females. The socioeconomic consequences of low back pain are substantial, including increased healthcare expenses, absenteeism from work, and a diminished quality of life.

Objective: To compare the effectiveness of short-wave diathermy with exercise, transcutaneous electrical nerve stimulation with exercise, and exercise alone among patients with chronic low back pain.

Patients and Methods: 75 patients who were diagnosed with chronic low back pain, ages 20–50, participated. They were divided into three groups: group A received shortwave with exercise, group B received TENS with exercise, and group C received just exercise. Treatment was given for 12 sessions over a period of 4 weeks. All patients were evaluated before and after treatment using a visual analog scale and the Oswestry Low Back Pain Disability Questionnaire.

Results: The results showed that all three interventions were effective in reducing pain and improving physical activities, with varying degrees of success. But also, the result showed that the mean difference for the short wave with exercise is much higher than both the TENS with exercise and the exercise alone types of interventions in each of the different categories, respectively.

Conclusion: This study has shown that shortwave exercise is more effective in the treatment of chronic low back pain than TENS with exercise and exercise alone.

Keywords: Shortwave, TENS, Exercise, Chronic low back pain.

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Introduction

Low back pain (LBP) is the most commonly documented kind of musculoskeletal pain, is frequently recurring, and has significant socioeconomic repercussions. At som e point in their lifetimes, low back pain affects eighty percent of the population, and chronic low back pain is the leading cause of activity restriction in young adults under the age of 45. Inadequate body mechanics as well as postural malalignment, a stressful lifestyle, decreased flexibility, and a lack of general physical fitness all contribute to the development of prevalent low back problems [1,2]. The most typical treatments for persistent LBP include various exercise techniques, thermotherapy, hydrotherapy, electrotherapy modalities, mobilization, manipulation, and traction [3]. The primary goal of chronic LBP therapy is to return to their expected level of activity as well as involvement, avoiding chronic complaints as well as recurrences. along with functional rehabilitation physiotherapy modalities like TENS and short wave, which are used to decrease pain as well as muscle spasms, enhance pain threshold, cause vasodilation, improve connective tissue flexibility, and increase joint mobility while used before exercise treatment [4]. Therefore, the aim of our study was to compare continuous SWD with exercise, TENS with exercise, and exercise alone to evaluate the effects of these treatments on chronic low back pain.

Patients and Methods

The study was performed on 75 people between the ages of 20 and 50, both female and male. The patient was diagnosed by a rheumatologist before starting treatment. The participants are divided into three groups: group A (25 patients) who underwent TENS and exercises; group B (25 patients) who underwent continuous short waves and exercises; and group C (25 patients) who underwent just exercise. The data was collected at Rizgari Teaching Hospital and Erbil Teaching Hospital during the period January 2022 to July 2022.

Inclusion and exclusion criteria

The patients who had pain for more than 3 months will be eligible, being aged between 20 and 50 years, being able to comply with the outpatient program, agreeing to participate in the study, and being diagnosed with chronic low back pain. The patients were excluded those who had various medical conditions, including neurological deficits, any type of lumbar or thoracic hernia, those who had radicular pain, severe osteoporosis or osteomalacia, uncontrolled diabetes and hypertension, infectious or inflammatory diseases, a history of cancer, epilepsy, pacemakers, fractures, spondylolysis, spinal stenosis, ankylosing spondylitis, previous low back surgery, cardiovascular disease that would prevent exercise, or any other conditions that would prevent the use of short-wave diathermy or TENS therapy [3].

Intervention & procedure

The study involved three groups of participants who were given 12 treatment sessions over a period of 4 weeks. Each treatment session lasted approximately 20 minutes and included various forms of therapy, such as short-wave therapy, TENS, and exercise. In the first attendance of the patients, a brief discussion was made about

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the nature of the study, and consent was obtained from all the participants. After that, first record the history of the patients. Secondary, ask the patient the pain score (0–10), and finally, a baseline assessment questionnaire (QLD) must be asked. The patients were assessed twice: once before the treatment and once at the end of the four-week treatment period.

Statistical Analysis

The data was analyzed using SPSS software version (26). The results are shown in descriptive statistics such as, mean and standard deviation for each group. Normality assumptions were assessed and based on their results; Parametric approach was utilized like Paired Sample t-test, to evaluate the methods per the each follow up. For all test $p < 0.05$ was considered to be statistically significant.

Results

Table (1) shows the descriptive statistics for all demographic parameters such as age, gender, walking status, and BMI from Patients with Low Back Pain. Most of the participants are aged between 30 and 39 years (41.3%) followed by more than 39 years (40%), and 20-29 (18.7%) respectively, since the average of their ages are 37 years. The percentage of female (62.7%) is higher than the percentage of male's participants (37.3%). Most of the responders in this survey are working on their foot (40%) followed by on chair (34.7%) respectively while (25.3%) of them do not have work (house wife). Most of the patients have overweight range of BMI (56%) followed by (34.7%) of them are normal and (9.3%) of them are obese as well as their average of BMI are 26.31.

Table (1): Descriptive Statistics for Socio Demographic parameters from Patients with Low Back Pain

		Frequency	%
Age	20 – 29	14	18.7%
	30 – 39	31	41.3%
	40 years and more	30	40.0%
	(Mean ± SD)	(37 ± 7.37)	
Gender	Female	47	62.7%
	Male	28	37.3%
Working status	On foot	30	40.0%
	House wife	19	25.3%
	On chair	26	34.7%
BMI	Less than 18.5 (Underweight)	0	0.0%
	18.5 - 24.9 (Normal)	26	34.7%
	25 - 29.9 (Over weight)	42	**56.0%**
	30 and more (Obese)	7	9.3%
	(Mean ± SD)	(26.31 ± 3.37)	

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Table (2): Descriptive Statistics between three types of interventions and both pre and post pain scores

		Type of device					
		Short wave with exercise		Tens with exercise		Exercise alone	
		F	%	F	%	F	%
Pre pain score	None	0	0.0%	0	0.0%	0	0.0%
	Mild	0	0.0%	0	0.0%	0	0.0%
	Moderate	11	14.7%	14	18.7%	15	20.0%
	Severe	14	18.7%	11	14.7%	10	13.3%
Post pain score	None	3	**4%**	0	0.0%	0	0.0%
	Mild	18	**24%**	11	14.7%	10	13.3%
	Moderate	4	5.3%	11	14.7%	15	20.0%
	Severe	0	0.0%	3	4.0%	0	0.0%

Table (2) shows the descriptive statistics between three types of interventions and both pre and post pain scores. The result shows that (4%) of patients do not have any pain at all in posttest using short wave with exercise, (24%, 14.7%, and 13.3%) of them reduced their pain to mild using (short wave with exercise), (Tens with exercise), and (exercise alone) respectively. Additionally, patients' moderate pain was reduced from 14.7% to 5.3% by using short wave with exercise, while their severe pain was decreased from 18.7% to 0%.

Paired Sample T Test

Paired sample t test compares the mean between two related (paired, repeated or matched) variables (Blbas et. al., 2020). Paired sample t-test were used to analyze the relationship between pre and post pain scores with each of the (pain intensity, personal care, lifting, walking, sitting, standing, traveling, and total pain score).

Table (3): Paired Sample T Test between the mean of pre and post pain score with physical activities from short wave with exercise intervention type

		Mean	Std. Deviation	t	p-value	Decision
Pain intensity	Pre	4.160	0.987	12.889	0.000	V. H. Sig.
	Post	1.840	0.746			
Personal care	Pre	3.440	1.227	9.277	0.000	V. H. Sig.
	Post	1.560	0.821			
Lifting	Pre	3.960	1.645	9.656	0.000	V. H. Sig.
	Post	1.880	0.971			
Walking	Pre	2.640	1.350	6.395	0.000	V. H. Sig.
	Post	1.400	0.707			
Siting	Pre	3.160	1.313	7.176	0.000	V. H. Sig.
	Post	1.720	0.737			
Standing	Pre	3.520	1.122	10.206	0.000	V. H. Sig.
	Post	1.800	0.816			
Sleeping	Pre	2.360	1.440	4.028	0.000	V. H. Sig.
	Post	1.480	0.653			

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Social life	Pre	2.960	1.274	8.764	0.000	V. H. Sig.
	Post	1.360	0.638			
Traveling	Pre	3.360	1.150	10.007	0.000	V. H. Sig.
	Post	1.600	0.764			
Pain Score	Pre	6.760	1.665	18.279	0.000	V. H. Sig.
	Post	2.160	1.462			

Table (3) shows there is a statistically significant difference between the mean pre- and post-pain scores with each of the (pain intensity, personal care, lifting, walking, sitting, standing, traveling, and total pain score) individually from the short wave with exercise intervention type because their p-values are less than the significant level of α = 0.05. In addition, the average post-pain score for each of them is lower than the average for pre-pain scores, which means that the pain of patients decreases at the end of the short-wave exercise intervention.

Table (4): Independent Sample T Test between the mean of pre and post pain score with physical activities from TENS with exercise intervention type

		Mean	Std. Deviation	t	p-value	Decision
Pain intensity	Pre	3.840	1.068	4.908	0.000	V. H. Sig.
	Post	**2.880**	1.013			
Personal care	Pre	3.520	1.295	10.392	0.000	V. H. Sig.
	Post	**2.320**	1.030			
Lifting	Pre	3.800	1.323	6.148	0.000	V. H. Sig.
	Post	**2.640**	1.440			
Walking	Pre	2.600	1.118	4.925	0.000	V. H. Sig.
	Post	**1.920**	0.997			
Siting	Pre	2.680	1.314	4.226	0.000	V. H. Sig.
	Post	**2.040**	0.889			
Standing	Pre	3.800	0.866	7.071	0.000	V. H. Sig.
	Post	**2.800**	1.000			
Sleeping	Pre	2.400	1.384	3.919	0.001	H. Sig.
	Post	**1.640**	0.757			
Social life	Pre	3.280	1.275	8.085	0.000	V. H. Sig.
	Post	**2.000**	1.155			
Traveling	Pre	3.160	1.179	7.184	0.000	V. H. Sig.
	Post	**2.240**	1.091			
Pain Score	Pre	6.440	1.685	10.971	0.000	V. H. Sig.
	Post	**3.920**	1.730			

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Table (4) shows there is a statistically significant difference between the mean pre- and post-pain scores with each of the (pain intensity, personal care, lifting, walking, sitting, standing, traveling, and total pain score) individually from TENS with exercise because their p-values are less than the significant level of $\alpha = 0.05$. In addition, the average post-pain score for each of them is lower than the average for pre-pain scores, which means the pain of patients decreases at the end of tens and exercise.

Table (5): Independent Sample T Test between the mean of pre and post pain score with physical activities from exercise intervention type

		Mean	Std. Deviation	t	p-value	Decision
Pain intensity	Pre	3.800	0.957	5.634	0.000	V. H. Sig.
	Post	2.920	0.909			
Personal care	Pre	3.360	1.186	10	0.000	V. H. Sig.
	Post	2.360	0.952			
Lifting	Pre	3.480	1.229	5.237	0.000	V. H. Sig.
	Post	2.680	1.145			
Walking	Pre	2.480	1.005	3.934	0.000	V. H. Sig.
	Post	1.920	0.909			
Siting	Pre	2.560	1.261	4.548	0.000	V. H. Sig.
	Post	1.840	0.943			
Standing	Pre	3.600	0.866	5.308	0.000	V. H. Sig.
	Post	2.880	0.927			
Sleeping	Pre	2.360	1.381	3.845	0.001	V. H. Sig.
	Post	1.640	0.860			
Social life	Pre	3.440	1.356	6.678	0.000	V. H. Sig.
	Post	2.120	1.054			
Traveling	Pre	2.800	1.041	5.018	0.000	V. H. Sig.
	Post	2.160	0.850			
Pain Score	Pre	6.400	1.528	12.389	0.000	V. H. Sig.
	Post	4.040	1.485			

Table (5) shows there is a statistically significant difference between the mean pre- and post-pain scores with each of the (pain intensity, personal care, lifting, walking, sitting, standing, traveling, and total pain score) individually from the exercise intervention type because their p-values are less than the significant level of $\alpha = 0.05$. In addition, the average post-pain score for each of them is lower than the average for pre-pain scores, which means the pain of patients decreases at the end of the exercise intervention type.

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Table (6): Mean difference comparison between three types of interventions

Categories	Mean difference		
	Short wave and exercise	Tens and exercise	Exercise
pain intensity	2.32	0.96	0.88
personal care	1.88	1.20	1.00
Lifting	2.08	1.16	0.80
Walking	1.24	0.68	0.56
Siting	1.44	0.64	0.72
Standing	1.72	1.00	0.72
Sleeping	0.88	0.76	0.72
social life	1.60	1.28	1.32
Traveling	1.76	0.92	0.64
pain score (total)	4.60	2.520	2.360

Table (6) shows the difference between the mean pre- and post-pain scores for three types of interventions. The result shows that the mean difference for short-wave exercise is much higher than both (TENS with exercise) and (exercise alone) types of interventions in each of the different categories, which means that patients pain is much reduced by short-wave exercise compared to others such as (TENS with exercise) and (exercise alone).

Discussion

The results of this study showed that the majority of patients with low back pain were between the ages of 30 and 39 years. This finding is consistent with previous studies that have identified middle-aged adults as being at increased risk for developing low back pain [5]. Additionally, the higher percentage of female participants in this study is also consistent with previous studies that have shown a higher prevalence of low back pain among females [6]. The finding that most of the participants work on foot and on a chair is also in line with previous studies that have identified occupation and work-related factors as significant contributors to low back pain [7].

Moreover, the prevalence of overweight and obesity in this study's participants is also consistent with studies that have linked higher BMI with an increased risk of developing low back pain [8]. However, it is important to note that some patients in the study were underweight or within the normal range of BMI, suggesting that other factors may contribute to the development of low back pain. The descriptive statistics of three types of interventions (short wave with exercise, TENS with exercise, and exercise alone) in reducing pain scores among patients. The results indicate that all three interventions were effective in reducing pain, with varying degrees of success. Short-wave exercise intervention had the highest success rate in reducing moderate and severe pain, with 5.3% and 0% of patients reporting these levels of post-pain intervention, respectively. This is consistent with previous research showing the effectiveness of short-wave therapy in reducing pain and improving function in patients with chronic low back pain [9].

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TENS with exercise intervention had a moderate success rate in reducing pain, with 14.7% of patients reporting mild pain post-intervention. This is also consistent with previous research showing the effectiveness of TENS in reducing pain in patients with chronic low back pain [10].

Exercise-only intervention had the lowest success rate in reducing pain, with only 13.3% of patients reporting mild pain post-intervention. However, exercise is still an important component in pain management as it has been shown to improve muscle strength, flexibility, and endurance, which can help reduce pain and improve function in patients with chronic low back pain [11, 12].

The results of the paired sample t-tests conducted to compare the mean pre- and post-pain scores for physical activities and total pain score in patients who received a short wave exercise intervention type. The results indicate a statistically significant difference between the mean pre- and post-pain scores for all the measures. This suggests that short-wave exercise intervention is effective in reducing pain and improving physical activities in patients with chronic low back pain.

The largest mean difference was observed for pain intensity, followed by lifting, personal care, traveling, standing, social life, sitting, walking, and sleeping, respectively. These findings suggest that short-wave exercise intervention is more effective in reducing pain intensity and activities that require more physical effort, such as lifting and personal care. These results are consistent with previous studies that have shown the effectiveness of short-wave therapy with exercise in reducing pain in patients with chronic low back pain [13]. The results indicate that TENS with exercise significantly improves physical activities and reduces the total pain score in patients with chronic low back pain. This finding is consistent with previous research that has demonstrated the efficacy of TENS with exercise in reducing pain in patients with chronic low back pain [10]. The highest mean difference was observed in the social life domain, suggesting that TENS with exercise may have a particularly beneficial effect on patients' ability to participate in social activities. This finding is consistent with the literature that suggests that pain can significantly impact social functioning and qu ality of life [14]. Therefore, the ability to improve social functioning can have a substantial impact on patients' overall well-being. Also, the results indicate that the exercise intervention type was effective in improving physical activities and reducing the total pain score. These findings are consistent with previous research that has shown exercise to be an effective intervention for reducing pain in patients with chronic LBP [15]. The p-values for all the variables were less than 0.05, indicating that the results were statistically significant. The post-intervention mean pain scores were lower than the pre-intervention mean pain scores for all the variables, indicating that all interventions had a positive effect on reducing pain. Finally, we can see a comparison of the mean difference between three types of interventions for low back pain. The final shows that short waves with exercise have a significantly higher mean difference in pain intensity compared to both TENS with exercise and exercise alone. This

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finding is consistent with previous research that has shown that short-wave therapy, also known as diathermy, can be an effective treatment for low back pain [16]. Short-wave therapy can improve circulation, reduce inflammation, and promote tissue healing, which can lead to a reduction in pain [16].

Conclusions

According to the results, all three interventions had a positive effect on reducing pain and increasing physical activity. But a short-wave exercise intervention had the highest effectiveness in reducing pain and increasing physical activity in patients with chronic low back pain.

Recommendations

Further studies are needed on this subject in the future because of the small size and short duration of this study. One issue was the low number of patients. New studies that feature larger sample sizes could help to verify our findings.

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Ethical clearance: This study was conducted according to the approval of College of Medicine/ University of Diyala and in accordance with the ethical guidelines of the Declaration of ethical committee of the College (document no.2023EGA765).

Conflict of interest: Nil

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مقارنة بين الإنفاذ الحراري على الموجة القصيرة والتحفيز الكهربائي للأعصاب عبر الجلد لطرق العلاج الكهربائي والعلاج بالتمرينات في حالات أسفل الظهر المزمنة

ايمان غفوري عبد الكريم [١] , روناك طاهر علي [٢]

الملخص

خلفية الدراسة: آلام أسفل الظهر هي مساهم كبير في الإعاقة العالمية، وتؤثر على الأفراد عبر مختلف الفئات العمرية. تشير الأبحاث إلى أن حوالي ٨٠٪ من الأشخاص سيواجهون آلام أسفل الظهر في مرحلة ما من حياتهم. هذه الحالة أكثر انتشارًا بين الأفراد في منتصف العمر وكبار السن، مع ارتفاع معدل حدوثها بين الإناث. العواقب الاجتماعية والاقتصادية لآلام أسفل الظهر كبيرة، بما في ذلك زيادة نفقات الرعاية الصحية والتغيب عن العمل وتدهور نوعية الحياة.

اهداف الدراسة: لمقارنة فعالية الإنفاذ الحراري الموجي القصير بالتمارين، وتحفيز العصب الكهربائي عبر الجلد بالتمارين والتمارين الرياضية وحدها بين المرضى الذين يعانون من آلام أسفل الظهر المزمنة.

المرضى والطرائق: شارك ٧٥ مريضاً تم تشخيص إصابتهم بآلام أسفل الظهر المزمنة، تتراوح أعمارهم بين ٢٠ - ٥٠ سنة. تم تقسيمهم إلى ثلاث مجموعات، المجموعة أ تلقت الموجة القصيرة مع التمرين، المجموعة ب تلقت TENS مع التمرين والمجموعة ج تلقت تمرينًا فقط. تم تقديم العلاج لمدة ١٢ جلسة لمدة ٤ أسابيع، وتم تقييم جميع المرضى قبل وبعد العلاج باستخدام مقياس بصري تناظري واستبيان أوسويستري لإعاقة آلام أسفل الظهر.

النتائج: أظهرت النتائج أن جميع التدخلات الثلاثة كانت فعالة في تقليل الألم وتحسين الأنشطة البدنية، بدرجات متفاوتة من النجاح. ولكن أظهرت النتيجة أيضًا أن متوسط الفرق للموجة القصيرة مع التمرين أعلى بكثير من كلا النوعين من التدخلات (التحفيز الكهربائي للعصب مع التمرين) و (التمرين وحده) في كل فئة من الفئات المختلفة، على التوالي.

الاستنتاجات: أظهرت هذه الدراسة أن الموجة القصيرة مع ممارسة الرياضة أكثر فعالية في علاج آلام أسفل الظهر المزمنة من التحفيز الكهربائي للعصب عبر الجلد مع التمارين والتمارين الرياضية وحدها.

الكلمات المفتاحية: الموجة القصيرة، تحفيز العصب الكهربائي عبر الجلد، التمرين، آلام أسفل الظهر المزمنة.

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تاريخ استلام البحث: ١٢ حزيران ٢٠٢٣

تاريخ قبول البحث: ٢٦ تموز ٢٠٢٣

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[١] قسم العلاج الطبيعي - الكلية التقنية الصحية والطبية في أربيل - جامعة أربيل التقنية – أربيل - العراق
[٢] قسم الأشعة والسونار- كلية التقنية الطبية - جامعة الكتاب - العراق