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Original Article

Comparative Effects of Pulsed Electromagnetic Field Therapy and Radiofrequency on Pain and Functional Disability in Patients with Chronic Low Back Pain

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ABSTRACT

Background: With a lifetime occurrence of 51 to 84%, globally the leading cause of disability is low back pain. The occurrence of 5 to 10% of cases is responsible for the highly valued treatments, indisposed leaves and individuals' intolerance having chronic low back pain. **Objective:** To compare the effects of pulsed electromagnetic field therapy and radiofrequency with a standardized exercise plan for patients with chronic low back pain. **Method:** A randomized controlled trial on the patients of chronic low back pain was conducted at physiotherapy clinics of Venus Aesthetics DHA Lahore. A sample of 70 patients was enrolled in the study using non-probability convenient sampling and allocated into two groups. The patients were assessed at baseline, 4th and 8th weeks for pain and disability index. The pain was rated using a visual analog scale, while disability was assessed using the Oswestry Disability Index. Data has been collected at the baseline, after 4 weeks and then followed up after 8 weeks. Group A was given pulsed electromagnetic therapy with conventional physiotherapy which includes knee to chest, bridging calf stretch, knee rotation, back extension and cat and cow posture. Group B was given conventional physiotherapy sessions with radiofrequency. The categorical data was presented as frequency and percentages and quantitative using mean and standard deviations. The groups were compared using Friedman ANOVA and Mann Whitney U test for within and between groups respectively at (CI 95%) p-value <0.05. **Results:** The study comprised 34.3% male and 65.7% female in Group A and 47.2% male and 52.8% female in the other group. Group A given pulsed therapy showed more improvement in functional disability and a decrease in pain than Group B treated with radiofrequency. In group A analysis showed a significant difference in improving pain and functional disability at week 4 with a significant difference at p-value<0.05. **Conclusion:** It showed results in improving pain and functional disability and presented with long-term goals when combined with the physiotherapy exercise plan. Radiofrequency is also effective but results are only temporary. Thus, radiofrequency does not support to treatment of patients having chronic low back pain.

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INTRODUCTION

Approximately an increase in healthcare expenses for patients having low back pain, which also increases the cost of spending on epidural corticosteroid injections and analgesic recommendations. Without any remarkable achievement in patient results or disease rate, there is also an increase in the usage of magnetic resonance imaging and vertebral fusion surgeries.[1] In correlation physical therapies have evolved so much in offering for low back pain. Spinal manual therapy, electrotherapy, soft tissue massage, taping and dry needling are the techniques, used for relieving the symptoms and correcting biomechanical problems. Only for the best short-term results, do these techniques or therapies show results when tested.[2] Pulsed electromagnetic field therapy might be used as a potential therapeutics for increasing soft tissue healing as PEMF is also seen to lessen the inflammatory markers and thus pulsed electromagnetic field therapy is frequently used in bone fracture healing.[3] In the whole body or centrally targeted particular body tissue, pulsed electromagnetic field therapy induces microcurrents characterized by the electromagnetic field which is a non-invasive technique.

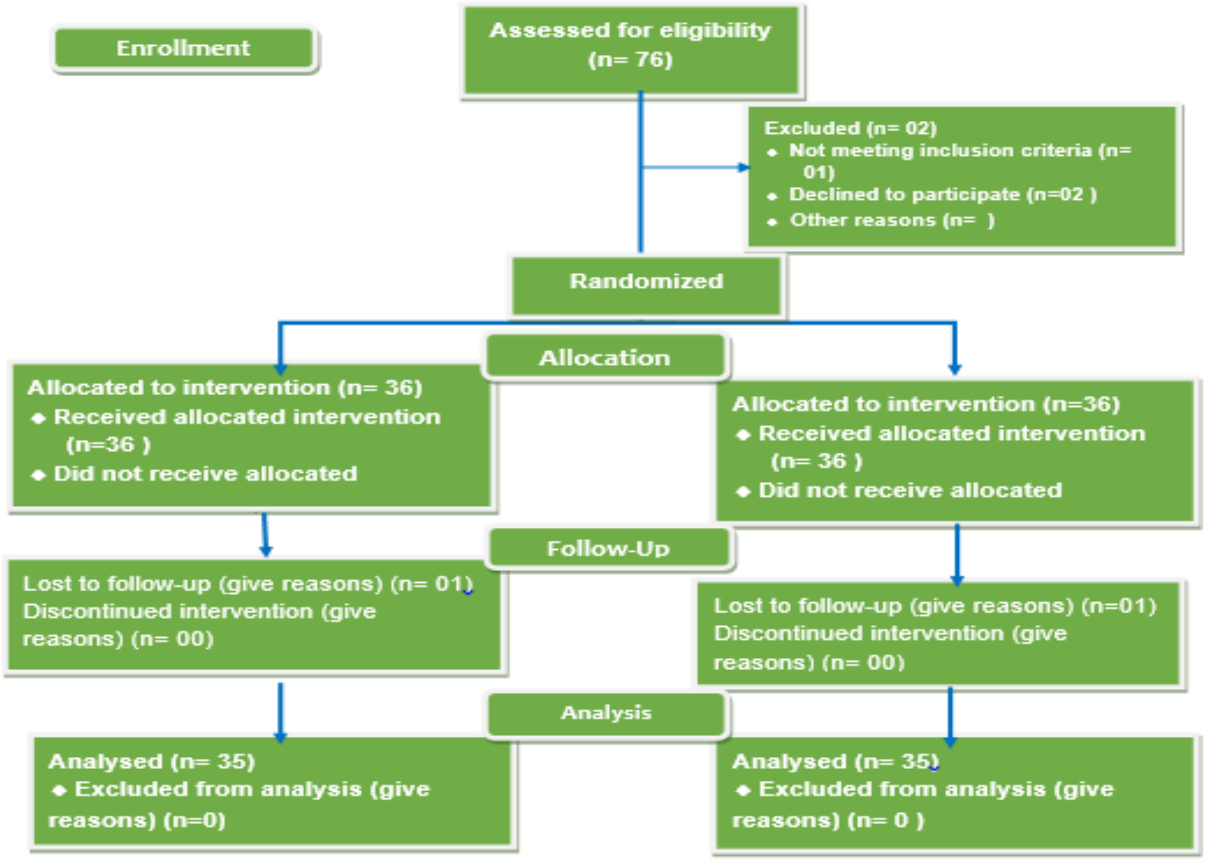
In several diseases like edema, postsurgical pain, treatment of chronic wounds, facilitation of vasodilation, osteoarthritis, Parkinsonism and for the direct exciting of the cells of nerve and muscles provoking angiogenesis they are exposed to PEMFs in the 0-300 Hz range which is a therapeutic tool used for the given pathologies.[4-6] A medical procedure known as Radiofrequency thermal-induced contraction of collagen is used in ophthalmology, orthopedic procedures and the treatment of varicose. It is reported that between 60 to 80 degree temperature causes collagen shrinkage. This temperature induces a reconstructing effect in collagen fibers but this does not cause any thermal obliteration of connective tissues in each type of collagen.[7-8] Vwaire Orhurhu et al. in 2019 organized a systematic review in which they enumerated that, for chronic knee pain treatment, radiofrequency shows results which is very useful, despite that regulation of temperature and treatment period wants some proper administration.[9] Johan N.S Juch et al. in 2017, reported that candidates having chronic low back pain related to facet joints, sacroiliac joints or due fusion of facet joints do not indicate any recovery when treated with a systematized exercise program as compared with the standardized exercise with radiofrequency denervation.[10] There are so many studies that have been conducted so far to treat chronic low back pain but in so many treatments there are no specific treatments that specifically treat low back pain. The main objective of this study is to determine the effects of PEMF and Radiofrequency on patients having low back pain to improve functional disabilities and pain intensity as there is no research has been conducted in which comparisons have been taken the major goal of this study is to introduce a new way of treating patients having low back pain combining with the standardized exercise program.

METHOD

Randomized controlled trials were conducted in the Physiotherapy Department of Venus Aesthetics at Lahore for 9 months. The calculated sample size using the sleep quality index as an outcome measure is 30 in each group, with $n= 2\sigma^2(Z_{1-\alpha/2} + Z_{1-\beta})^2/(\mu_1 - \mu_2)^2$ after adding 20% dropout the sample size was 30+5=35 in each group, where $Z_{1-\alpha/2}$ level of significance = 95%, μ_1 expected mean change in VAS in Group A 1.95,[11] μ_2 expected mean change in VAS in Group B 2.23, δ_1 expected standard deviation in Group A 0.17, δ_2 expected standard deviation in Group B 0.52, $Z_{1-\beta}$ power of the study 80%, n is the expected sample size in a group of 35. About 70 participants in the two groups were divided

equally into two groups with 35in each. Non-probability convenient sampling was used for sample collection. The patients aged 30-55 years, both genders, with a pre-diagnosed non-specific chronic low back pain >3 months having pain intensity >3 on the visual analogue scale were enrolled. The patients with any of the spinal tumors, sciatica, previous history of surgery, neurological disorders, steroids pregnant females and radiculopathy were excluded. Venus's legacy machine was used as an outcome tool. Group A was given PEMF therapy with conventional physiotherapy which includes knee to chest, bridging calf stretch, knee rotation, back extension and cat and cow posture. Group B was given routine physiotherapy sessions which included knee to chest, bridging calf stretch, knee rotation, back extension and cat and cow posture with radiofrequency. The pain was rated using the visual analogue scale and functional disability using the Oswestry disability index. During the procedure, certain frequencies are set to reach the optimal body temperature which is between 42-45˚C. The duration of the treatment is 25-30 minutes. Data has been collected at the baseline, after 4 weeks and then followed up after 8 weeks. The data was analyzed using SPSS V 22 and the categorical data was presented as frequency and percentages and quantitative using mean and standard deviations. The groups were compared using Friedman ANOVA and Mann Whitney U test for within and between groups respectively at (CI 95%) and p-value <0.05. The mean age value for Group A is 43.42±7.21 while for Group B is 44.14±6.44.

Figure I: Consort flow diagram



RESULTS

The results regarding the gender of participants showed that there were 34.3% male and 65.7% female in Group A and 47.2% male and 52.8% female in Group B (Table I). In Group A baseline ODI mean value was 38.97± 3.98, while in the 8th week ODI mean was 28.11±2.11. In Group B mean ODI was 41.94±3.34 at the baseline and 33.31±2.82 (Table II). The mean rank for the VAS baseline reading was 3.85 and the p-value was 0.00. The mean rank of VAS for the 4th week was 3.09 and the p-value was 0.00. The mean rank of VAS 8th week was 2.06 and the p-value was 0.00. According to the results, group A showed significant change during baseline, 1st to 8th week of treatment (Table III). The mean rank for pain at baseline in group A was 28.90 and for group B was 42.10 with, a p-value of 0.004. The mean rank for VAS 4th week was 20.24 for group A and 50.76 for group B and in the 8th week was 18.11 for group A and 52.89 for group B, showing significant effects ($p<0.05$) in Table IV. Between-group comparison of Groups A and B based on ODI and the mean rank of the ODI baseline reading of Group A was 28.31 and for Group B was 42.69 with a p-value of 0.00. The results showed that there was a statistically significant difference between the groups with the p-value <0.05. According to

Table I: Demographics of Participants

Demographics		(Group A) PEMF + Physiotherapy	(Group B) Radiofrequency + Physiotherapy
Gender	Male	12(34.3)	17(47.2)
	Female	23(65.7)	18(52.8)
Age (years) Mean±SD		43.42±7.21	44.14±6.44

Table II: Descriptive Statistics - Oswestry Disability Index for Low Back Pain

Group (Intervention)		Baseline	4th week	8th week
(Group A) PEMF + Physiotherapy	Mean	38.97	32.05	28.11
	Std. Deviation	3.98	2.54	2.11
	Minimum	32.00	28.00	20.00
	Maximum	46.00	36.00	30.00
(Group B) Radiofrequency + Physiotherapy	Mean	41.94	38.57	33.31
	Std. Deviation	3.34	2.14	2.82
	Minimum	36.00	32.00	28.00
	Maximum	48.00	42.00	38.00

Table III: Within-group Comparison of Pain

Pain	N	Mean	Std. Deviation	Mean Rank	p-value
Baseline	35	7.4	.82357	3.85	.000
4th-week	35	6.2	1.0310	3.09	
8th-week	35	4.3	1.5911	2.06	

Table IV: Between-group Comparison of Pain

Pain	Groups (Intervention)	n	Mean rank	p-value
Baseline	(Group A) PEMF + Physiotherapy	35	28.90	.004
	(Group B) Radiofrequency + Physiotherapy	35	42.10	
4th-week	(Group A) PEMF + Physiotherapy	35	20.24	.000
	(Group B) Radiofrequency + Physiotherapy	35	50.76	
8th-week	(Group A) PEMF + Physiotherapy	35	18.11	.000
	(Group B) Radiofrequency + Physiotherapy	35	52.89	

These results, there is a significant difference in PEMF and radiofrequency on the Oswestry disability index (Table V).

DISCUSSION

The main finding of this study is to compare the effects of two therapies on reducing pain and functional disability in non-specific chronic low back pain. Musculoskeletal-related lower back pain is the early cause of retirement because of the inability to do work second to mental disorders.[12] This randomized controlled trial introduces revitalizing results for the use of PEMF with routine physical therapy and other than radiofrequency in patients with chronic low back pain. Outcome measures at the baseline, 4th and 8th week during the treatment. Both therapies show statistically significant differences which means PEMF shows more effective and progressive results than radiofrequency in improving pain and functional disability. The pain was not reducing as much at the start but decreased with sessions with no unfavorable effects. Zayed studied that low-frequency PEMF showed results in improving pain and Zayed studied that low-frequency PEMF showed results in improving pain and dysfunction in the treatment group as compared to the placebo group in patients with long-term low back pain, with mean pain at NPRS is 2.95 ($p<0.001$) at week 13.[12]

Table V: Between-group Comparison for Oswestry Disability Index

Ranks				
Outcome	**Group (Intervention)**	**N**	**Mean rank**	**P-value**
Baseline ODI	(Group A) PEMF + Physiotherapy	35	28.31	.003
	(Group B) Radiofrequency + Physiotherapy	35	42.69	
4th-week ODI	(Group A) PEMF + Physiotherapy	35	19.11	.000
	(Group B) Radiofrequency + Physiotherapy	35	51.89	
8th-week ODI	(Group A) PEMF + Physiotherapy	35	20.29	.000
	(Group B) Radiofrequency + Physiotherapy	35	50.71	

The 2.8 is the mean pain value on VAS in the 8th week which showed that PEMF is more effective in reducing pain in LBP. Both researches support each other findings. In 2017 in a randomized trial by John. N.S. and colleagues stated that in three months of clinical trials, patients with chronic low back pain treated with a standardized exercise program and radiofrequency have not shown any improvement in decreasing pain with mean pain on NRS being 7.1 at baseline.[12] This study does not support the John et al statistics as according to the results radiofrequency shows a reduction in pain but not as much because the reduction of pain is temporary and not for long-term results. This research supports the effectiveness of PEMF as compared to radiofrequency. The mean ODI of group A which is treated with PEMF and routine physiotherapy is 28.114 in the 8th week while the mean ODI of group B having Radiofrequency plus physiotherapy is 33.3143. The findings of AJ. Lisi, a randomized controlled trial in which 42 patients were randomized, using PEMF with regular care in the first group while sham with regular care in another group. There was a remarkable change in ODI with p=0.135) in the sham group.[13] 35 participants in each group took part in this study with the follow-up of the 8th week. Group B having Radiofrequency with routine physical therapy with mean ODI and pain at baseline are 41.94 and 7.6 compared to the results in the 8th week 33.31 and 5.7 respectively which described that this treatment is also effective in lowering pain and improving functional disability. In this RCT, Khalil and colleagues studied that, Radiofrequency ablation is significantly important in improving pain and function in patients having low back pain with a follow-up of three months.[14]

Chronic low back pain is a cluster of musculoskeletal disorders that used to disturb the ADLs. According to the findings subgroups of chronic LBP, must need special attention for precisely specific treatment. PEMF therapy is proven an effective treatment for chronic LBP, but more studies or trials with the addition of different factors can increase the validity of findings. We recommend a combination of both PEMF and radiofrequency with routine physical therapy

as both can do wonders in treating chronic lower back pain.

CONCLUSION

Pulsed electromagnetic field therapy helps reduce pain and enhance functional disability in patients with chronic low back pain with routine physiotherapy. Although other comparative techniques Radiofrequency with routine physical therapy are also effective the effectiveness is only temporary with no statistically significant difference as compared to this therapy.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

Funding: No funding source is involved.

Authors' contributions: All authors read and approved the final manuscript.

CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

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