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Comparative Study of Physiotherapy Modalities and Exercise in Low Back Pain

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Abstract: Objectives: Comparative study of physiotherapy modalities and exercise in Low back pain. **Design:** Randomized Control Trial. **Methodology:** 20 Participants with a history of Chronic low back pain (CLBP) were randomly assigned into 5 groups; control group G1 ($n = 4$) that receive exercises only and 4 experimental groups (*each with n = 4*). The experimental groups are G2 (Ultrasound + exercise), G3 (IR + exercise), G4 (TENS with hot pack + exercise), and G5 (vibration massage + exercise). Each participant was treated 3 times weekly, for two weeks and each exercise repeated (10 × 5) along the period of study (2 weeks). The outcome measures used in this study were the Oswestry Disability Questionnaire (ODQ) and the Visual Analogue Scale (VAS) both of which were scored by all participants. **Results:** The VAS readings indicated a significant difference at the 1% level ($p = 0.003$) between the control group and the experimental groups, and showed highly significant in participants that treated with electric stimulation, then TENS with hot bag for 15 min. and followed by stretching and strengthening exercises as compared with the control group that received only the exercises. Also, ODQ readings showed significant difference ($p = 0.123$) between the control and treated groups. Results showed an improvement across experimental groups in pain and disability scores. **Conclusion:** The results of this study showed that TENS and hot pack with exercises have a better effect on improving pain and disability in participants suffering from CLBP. Interestingly, the control group who had postural re-education did improve as well as the core stability group. Age was not considered to be a factor when allocating participants into 5 groups. However, the younger age group showed marked improvement with posture re-education and exercise.
Keywords: Ultrasound, Chronic Low Back Pain, hot Pack, Exercise, TENS.

Introduction

Low back pain (LBP) is a major health problem with two thirds of adults suffering from LBP at some time in their lives and approximately 12% to 44% have LBP at any given time. LBP is common among office workers with the one-year prevalence ranging from 23% to 38% [1].

Low back pain (LBP) is defined as pain located below the costal margin and above the inferior gluteal folds. Specific causes of LBP are uncommon, accounting for less than 15% of all back pain. However, there are various causes of low back pain. The most common causes are the low back structure, biomechanical factors and regressive changes in surrounding tissues, psychological factors, and various types of infections, metastatic osteosarcoma, and congenital spinal abnormality [1, 2].

Clinical pain is generally classified as acute or chronic and is divided into two major categories: inflammatory and neuropathic pain. Combinations of inflammatory and neuropathic pain do occur, for example, in postsurgical, cancer and back pain. When low back pain persists for 3 months, it is considered chronic and may cause progressive physical and psychological effects [3].

Chronic low back pain (CLBP) refers to chronic pain around the lumbar vertebra sustained for over three months without serious pathological characteristics, regardless of the existence of sciatalgia). CLBP causes pain and changes in the muscles, as well as decreases in contractile force and muscle activity. It also affects vertebral movement [4].

Low back pain is named intense if the length of time of pain is under 6 weeks, sub-acute if the span is between 6 weeks and 12 weeks, and incessant if the term is more than 12 weeks. Most low back pain goes on for 2 to 3 months. On the other hand, repeat is extremely regular. Despite the fact that most repeats can be dealt with, 5 to 15% can't be dealt with, and the patients keep on encountering pain [5, 6].

Low back pain has been considered as a recurring human disease. In order to walk upright and hold that position, humans exert increasing heavy burden on the lumbar region. LBP results from many factors (multifactorial disease), so it cannot be managed by a simple treatment. Even though most recurrences can be treated, 5 to 15% cannot be treated, and the patients continue to experience pain [7].

Sitting for more than a large portion of a work day in mix with ungainly stances or much of the time working in a forward twisted position has been found to improve the probability of having LBP. Poor workstation ergonomics has been shown to significantly contribute to the development of LBP. The most widely recognized reasons are the low back structure, biomechanical variables and backward changes in surrounding tissues, mental components, and different sorts of infections, metastatic osteosarcoma, and innate spinal variation from the normal. Different psychosocial issues, for example, high stress, low employment fulfillment, low social backing and exertion reward imbalance likewise added to an expanded event of LBP. Clinical elements are for example, scoliosis [8-11], low back muscle endurance, poor lumbar strength and anomalous trunk mobility [12, 13] has been connected to expanded danger of LBP.

Previous studies have identified several individual factors associated with LBP including female، level of education, smoking, sleep deprivation, prolonged driving. Regarding work-related risk factors, accumulated computer usage has been linked to increased risk of LBP. Also, investigated the trunk muscular activation and muscle fatigue of LBP patients using electromyography (EMG) and compared the results with those of healthy adults. The most frequent site showing pathological changes is the 4^{th} and 5^{th} lumbar vertebrae, where the multifidus muscles are located. The median frequency of EMG has been used as a fatigue index to compare the back muscular fatigability of the left and right sides between 40% maximal voluntary contraction (MVC) and 80% MVC, and the median frequency imbalance was significantly larger in LBP than in healthy subjects [14].

Several studies of therapeutic approaches to LBP pain reduction, muscular strength improvement, and spinal movement enhancement have investigated the effects of myofacial release, osteopathy, massage, lumbar stabilization exercises, and proprioceptive neuromuscular facilitation (PNF) [15]. Most studies have measured the effects of interventions for LBP using functional fitness or a subjective questionnaire. Few studies have measured the effects of exercise intervention on muscular strength and endurance. In addition, due to the possible influence of psychological factors, using the slope of the median frequency may be a relatively objective way of measuring muscular endurance compared to using maintenance time only.

Previous studies have demonstrated that exercise on an unstable surface, such as exercises on a Swiss ball and sling exercise training (S.E.T), increases muscular activation levels. The activation levels of the internal and external oblique muscles increased during bridge exercise with vibration training on an unstable surface. Exercise on an unstable surface challenges the motor control system, the increasing the speed and intensity of lumber stabilizers, contraction and the activation ratio as well as improving muscle activation synergy [16].

Thus, the present study aims to train injured and healthy supporting tissue, facilitate tissue repair and prevent structural weakness from excessive loading by using traditional exercises for LBP, electrotherapy, and combination both of them.

Material and Methods

Inclusion criteria: 20 Participants with a history of Chronic low back pain CLBP prolonged more than 6 months ago, aged from 24 to 65 years, weight from 55 to 89 kg, and height from 159 to 187 Cm and body mass index (BMI) from 24.9 to 35.7, were selected from Al-Ahly polyclinic, after they agreed to participate in the study and then receiving explanations regarding the purpose and procedures of the study, and signed an informed consent statement before participation. At the time of the study the participants were not receiving any medical or physical therapy.

Exclusion criteria: Participants were excluded if they reported spinal, intra-abdominal or femoral surgery in the past year, a history of trauma or accidents or had been diagnosed with rheumatoid arthritis, ankylosing spondylitis, systemic lupus erythymatosus or osteoporosis. Those who had any contraindications for physical tests, such as cardiovascular diseases or severe pulmonary diseases, were also excluded.

Study groups: After a verbal explanation of the study protocol, the selected 20 participants were randomly assigned into 5 groups; control group G1 ($n = 4$) that receive exercises only such as stretching, and 4 experimental groups (*each with* $n = 4$). The experimental groups are G2 (Ultrasound; continuous WTS^2, with frequency 100 Hz, for 12 min. + exercise) G3 (IR; for 15 min. + exercise) G4 (electric stimulation, TENS with hot bag; for 15 min. + exercise), and finally G5 (vibration massage; for 7 min. + exercise).Each participant practice 3 times weekly, for two weeks and each exercise repeated (10 × 5) along the period of study (2 weeks, 1 Oct.. to 15 Oct., 2016).

The outcome measures used in this study were the Oswestry Disability Questionnaire (ODQ) and the Visual Analogue Scale (VAS) both of which were scored by all participants.

Data analysis

Standard deviation and mean for the obtained data were calculated. Also, the data obtained were analyzed by SPSS 13.0 software test to compare the data before and after treatment within groups. The significant threshold set at $p < 0.05$, or non-significant set at $p > 0.05$.

Results

The ODQ is used to score disability induced by low back pain (LBP). It is a validated tool that is designed to assess a patient’s level of function or disability, providing quantitative data that are suitable for quality assurance and research purposes. The VAS scale is a valid and reliable tool to rate pain intensities along a 10cm line. The patient is asked to put a mark along this line to reflect the intensity of the pain.

A total of 20 participants were eligible to take part in this study. These were divided into 5 groups; control group G1 ($n = 4$) and treated or experimental groups from G2- G5 ($n = 4$ for each).

The VAS readings indicated a significant difference at the 1% level ($p = 0.003$) between the control group and the experimental groups, and showed highly significant in participants that treated with TENS and hot pack for 15 min. and followed by stretching and strengthening exercises as compared with the control group that received only the exercises. Also, ODQ readings showed significant difference ($p = 0.123$) between the control and treated groups.

Results showed an improvement across experimental groups in pain and disability scores, as illustrated in Table 1 and Figure 1.

In control group G1, the average VAS was 6.2cm upon entry to the program and the average ODQ score was 43.4% before treatment. Two weeks later, average scores were 5.9 cm for the VAS and 40.7% for the ODQ.

The average VAS score for experimental groups was 8.5 cm, 6.5 cm, 7.6 cm, and 7.1 cm, for groups G2, G3, G4, and G5, respectively upon entry to the program, and ODQ results showed that the average disability measure pre-intervention was 46.6%, 42.8%, 39.9%, and 40.5% for groups G2, G3, G4, and G5, respectively. Two weeks later, average scores of VAS stood at 5.4 cm, 5.9 cm, 6.4 cm, and 6.3cm for groups G2, G3, G4, and G5, respectively. However, the results of ODQ after two weeks of treatment become 35.1%, 39.2%, 36.8%, and 38.4%, for groups G2, G3, G4, and G5, respectively (Table 1 and figure 2).

From the mentioned results, group G2 after two week of exposure to Ultrasound and practice on stretching and strengthening exercise at home showed the best improvement in scores and pain relief as compared with the control and other experimental groups (Table 1 and figure 3).

Table 1. Showing the values of VAS and the percentage of ODQ before and after the treatment.

	Before treatment					After treatment				
	G1	**G2**	**G3**	**G4**	**G5**	**G1**	**G2**	**G3**	**G4**	**G5**
VAS (cm)	6.2	8.6	6.5	7.6	7.1	5.9	5.4	5.9	6.4	6.3
% of ODQ	43.4	46.6	42.8	39.9	40.5	40.7	35.1	39.2	36.8	38.4

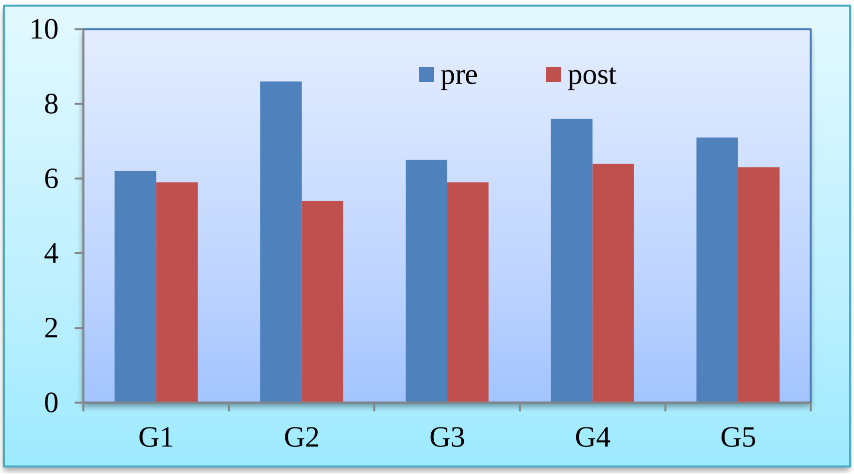

Figure 1. Showing a histogram for the values of VAS pre- and post- treatment.

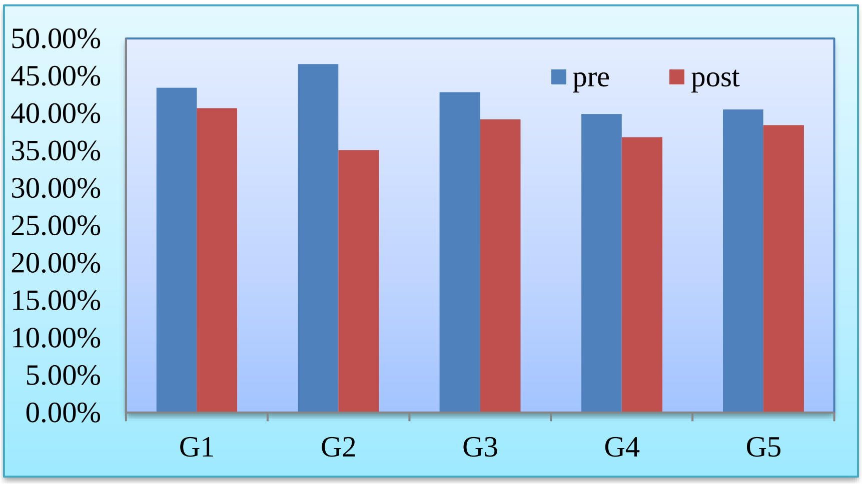

Figure 2. Showing a histogram for the values of ODQ pre- and post- treatment.

Age-related pre- and post-test differences were interesting. As shown in Figure 3, the 16-35-year-old age group improved by 70% on VAS scores and by 23% on ODQ scores. The 36-50-year-olds scored an average of 24% improvement on the VAS and 9% on the ODQ while the 51-65-year-olds improved by 35% and 16% on the VAS and ODQ respectively (Table 2 and figure 3).

Table 2. Showing the percentage of improvement for VAS and ODQ related to age of participants.

Age/year	% of improvement	
	For VAS	For ODQ
24-35	70	23
36-50	24	9
51-65	35	16

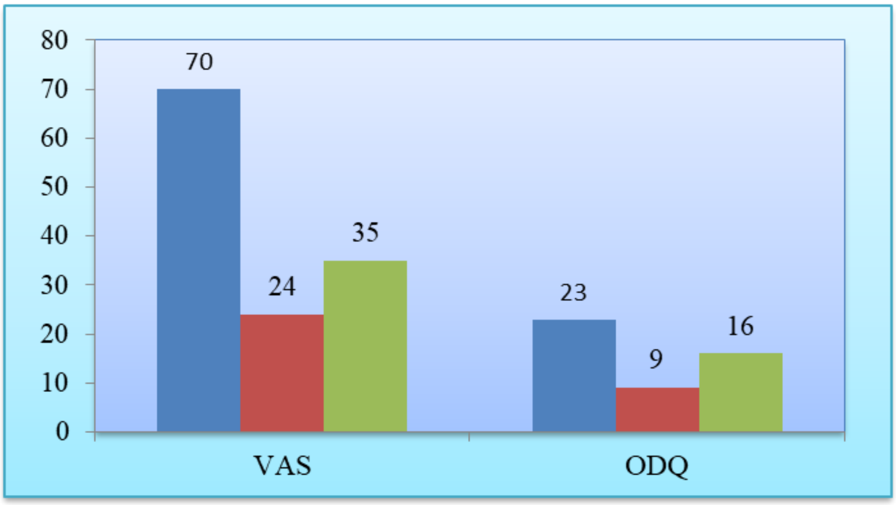

Figure 3. Showing the percentage of improvement for VAS and ODQ related to age of participants.

Discussion

The aim of this study was to evaluate the effect of combination of continuous ultrasound, IR, electric stimulation plus TENS and vibration massage with exercises on participants with CLBP. A pre-test/post-test design was implemented over a period of two weeks. Outcome measures consisted of ODQ and VAS scores.

Two weeks after program, pain and disability scores improved in treated groups. At two weeks post-intervention, G4 (electric stimulation, TENS with hot bag; for 15 min. + exercises) showed the most significant improvements in both ODQ and VAS scores.

Participants in treated groups had undergone the core stability program had better VAS outcomes than those in control group. The opposite was true with the ODQ results at 2 weeks. These findings are comparable to those of similar research studies in which the effects of core stability exercises were investigated [17]. The evidence is inconclusive as to which type of exercise is best and actually leans towards incorporating any general exercise program to improve function. O'Sullivan et al. [18] found that reduction of pain and functional disability levels which were statistically significant were maintained at 30 months in participants who had undergone core stability rehabilitation [18].

It is noteworthy that the participants had been randomly assigned to 5groups without considering that age differences could affect outcomes. The distribution of ages between groups appears to relate to the initial results and may have introduced a bias in favour of groups as age-related differences were striking. The 16-35-year-old participants showed the greatest improvement, which finding could be due to several factors such as healing occurring faster in younger populations. The youth are more body and movement aware, so they assimilate exercises more easily. Also, they were more likely to be cases of first incidence of LBP, which would be easier to treat than recurrent episodes, or chronic LBP.

The 36-50-year-old participants showed the least improvement. This may be because the patients in this age group are likely to have had the greatest physical demands due to their lifestyles at work and at home, and also the least time for their own well-being. The 51-65-year age group had a better outcome than their younger counterparts, which may reflect the fact that they had more time for themselves and so were more likely to implement their home exercises program (HEP). It would have been a good idea to record compliance to the HEP with a diary. Another factor contributing to the results obtained for the older groups may have been chronicity of pain.

Recent research has focused on the evaluation of the activities of the trunk muscles in bridging exercises. This study was conducted to determine more efficient methods for increasing the activities of the trunk muscles in prone bridge exercises. The results reveal there were significant differences among the exercise methods in the activities of the IO, EO, RA, and ES muscles. In prone bridge exercise, the activities of the RA, EO, and the IO muscles were higher than control group.

Conclusion

The results of this study showed that TENS and hot pack with exercises have a better effect on improving pain and disability in participants suffering from CLBP. Interestingly, the control group who had postural re-education did improve as well as the core stability group. Age was not considered to be a factor when allocating participants into 5 groups. However, the younger age group showed marked improvement with posture re-education and exercise. These results are clinically significant. Further longitudinal studies in this area are called for, with a recommendation that participants are followed up for at least one year post-intervention in order to find out which approach has better long-term outcomes.

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