ORIGINAL ARTICLE

A COMPARATIVE STUDY OF ABDOMINAL STRENGTHENING VERSUS SPINAL EXTENSORS STRENGTHENING ACCOMPANIED WITH SWD IN REDUCING PAIN IN CHRONIC LOW BACK ACHE

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HOW TO CITE THIS ARTICLE:
Manju Jayaram, Kumar M, R. Raja, Prashantha S, Rajeeva A, Veena J, Rajini S. Rao. "A Comparative Study of Abdominal Strengthening Versus Spinal Extensors Strengthening Accompanied with SWD in Reducing Pain in Chronic Low Back Ache". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 14, April 06, 2015; Page: 2158-2165.

ABSTRACT: BACKGROUND: Chronic low back ache is one of the most common health problems affecting around 80% of the population sometime during their lifetime. It mostly affects the working age-group, have major economic impact. Exercise programs, designed to strengthen muscles, maintain and increase the range of movements and improve endurance are the cornerstone of management of chronic low back pain. Shortwave diathermy is a proven therapy for these patients. **OBJECTIVES:** To assess the effectiveness of abdominal strengthening and spinal extensors strengthening along with SWD in reducing pain, disability and improving range of motion in subjects with chronic low back ache, and to compare this effectiveness between the two groups. **METHODS:** Sixty subjects aged 30-50 years with chronic low back ache were treated with either abdominal strengthening exercises or SWD (Group A, n=30) or spinal extensor strengthening exercises and SWD (Group B, n=30) at a frequency of 3 times a week for 8 weeks. Treatment outcomes were assessed using Visual Analog Scale (VAS) for pain intensity, Modified-Modified Schober's Test for range of motion, and Modified Oswestry Disability Questionnaire (MODQ) for functional disability. **RESULTS:** After eight weeks of intervention, in both treatment groups, there was a significant improvement in all three parameters, when compared to baseline (VAS scores: Group A, 7.03±0.77 at baseline vs. 1.60±0.56 at Week 8 and Group B, 7.37±0.86 vs. 2.23±0.57; MMST: Group A, 12.23±1.33 vs. 21.73±1.02 and Group B, 12.70±1.34 vs. 20.47±1.04; MODQ, Group A, 43.85±8.43 vs. 13.63±4.11 and Group B, 51.75±9.40 vs. 18.67±3.51; $P<0.05$ for all comparisons). **CONCLUSION:** Shortwave diathermy with abdominal strengthening exercises is more effective than with spinal extensor strengthening exercises in reducing pain and enhancing functional performance in subjects with chronic low back ache.
KEYWORDS: Chronic low back pain, Exercises, Shortwave diathermy, Pain, Range of motion, Disability.

INTRODUCTION: Chronic low back pain is a widely prevalent disorder that causes a significant burden to the society in terms of loss of work time and increased economic cost.[1] It refers to low back pain lasting longer than 12 weeks duration.[2]

The peak age of incidence is 30–50 years, and affects females more than males.[3] As it affects people in the working age group, the resultant disability and work-absenteeism has a major economic impact on the society.[4] Additionally, it causes low self-motivation and self-confidence of the individuals suffering and makes it difficult to return to work, especially when problems at work are because of the reason for sick leave.[3]

Low back pain can occur because of multiple aetiologies. It can be due to mechanical causes, i.e., chronic strain on muscles of lower back caused by obesity, wear and tear, pregnancy, job oriented-stooping, bending and stressful postures. Organic conditions like tumours, ankylosing spondilitis, herniated spinal disc, degenerative spondylosis, spondylolisthesis, spinal stenosis, rheumatoid arthritis, trauma causing lumbar fractures and congenital deformities are other serious causes of low back pain.[5,6]

There are also a myriad of management options. People prefer conservative approaches, without medications, intervention or surgery. Patients prefer either active therapy like yoga and pilates or passive therapy like massage, superficial or deep heat, spinal manipulation and transcutaneous electrical nerve stimulation (TENS). Acupuncture, cognitive behavioral therapy and biofeedback are other management options.[7]

Exercise is commonly used in the management of chronic low back pain.[8] Exercise therapy has been defined as "a series of specific movements with the aim of training or developing the body by a routine practice or physical training to promote good physical health".[9] Eexercise for chronic low back pain focuses on various aspects including parameters ranging from training for general strength and endurance, to that for specific muscle coordination and control. The principle behind these assumptions is that improving neuromuscular function will result in restoration or augmentation of the control and support of the spine and pelvis.[8]

Abdominal strengthening and spinal extensor exercises improve strength, reduce disability and reduce pain and therefore seem to be effective in treating chronic low back ache.

Transversus abdominis muscle is the deepest abdominal muscle and stabilizer of the spine. It is the main trunk flexor along with other abdominal muscles. This muscle along with the multi fidus forms the internal corset that stabilizes the spine during movement. In chronic low back pain this muscle is weakened, resulting in pain and functional disability. Isometric contraction of this muscle reduces pain intensity, improves activities of daily living, and improves functional strength and coordination.

Erector spinae muscle is the main lower back spinal extensor which along with multifidus stabilizes the posture and eccentric control of trunk flexion. Strengthening of these muscles promotes normal physiological lumbar lordosis, allowing it to withstand axial compression loads, improves muscle recruitment strength and endurance of spine and back, and improves mobility of spine. In case of suspected disc prolapsed, these exercises unload the disc and allow fluid influx.[10]

Of the various electrotherapy modalities used in clinical practice, short wave diathermy has been demonstrated to be effective in treating chronic low back pain.[11] This is a therapeutic device which produces heat in the connective tissues by electromagnetic waves.[12] In chronic low back pain, it is used to reduce muscle spasm, reduce pain by vasodilatation and excretion of metabolites, increase connective tissue elasticity, relieve musculoskeletal sprains and strains, increase joint range of motion and decrease joint stiffness.[13]

In this study an effort has been made to compare weather SWD with abdominal strengthening exercises and SWD with spinal strengthening exercises are effective in reducing pain and improving functional ability in chronic low back ache.

The current study was conducted to assess the effectiveness of abdominal strengthening and spinal extensors strengthening along with SWD in reducing pain, disability and improving range of motion in subjects with chronic low back ache, and to compare this effectiveness between the two groups.

MATERIALS AND METHODS: This was a randomized, prospective, comparative study, where subjects with chronic low back pain were equally allocated to two groups, either to receive SWD with abdominal strengthening exercises (Group A) or SWD with spinal extensor strengthening exercises (Group B). Subjects were recruited from two tertiary care hospitals in Bangalore city.

A total of 60 subjects (30 in each arm) were included in the study. Subjects with chronic low back pain in the age group of 30-50 years belonging to both genders were included in the study. Those with any organic pathology like spinal cord injury, disc prolapse, radiculopathy, osteoporosis, spondylolisthesis, spinal stenosis and spinal tumors, morbid obesity, uncontrolled diabetes and hypertension were excluded from the study.

Written informed consent was obtained from all subjects. The study was approved by the Institutional Ethics Committee.

At baseline, all subjects were assessed for pain intensity using Visual Analog Scale (VAS),14 functional disability using Modified Oswestry Disability Questionnaire (MODQ)15 and range of motion using Modified Modified Schober's Test (MMST)16 for only lumbar flexion. All parameters were assessed at baseline and at the end of treatment (week 8). In addition, the pain intensity and functional ability were also assessed at week 4.

Short wave diathermy was administered to both groups for duration of 20-30 min.

Abdominal strengthening exercises included isometric contraction of transversus abdominis, pelvic tilts, half curls, basic abdominal crunch, knee to chest exercises, bridging, oblique curls and straight knee rising.

Spinal extensor strengthening exercises included prone kneeling with contralateral arm and leg rising, and prone lying with chin clearance, shoulder clearance, toe clearance, contralateral arm and leg raising and holding, and hyperextension.

STATISTICAL ANALYSIS: Descriptive statistical analysis was carried out in the present study. Pain, functional ability and lumbar range of motion for flexion are presented as Mean±standard deviation (SD) and results of categorical measurements are presented as number (%). Chi square test was used to analyze the characteristics of the samples. Student 't' test (two tailed, independent) was employed to test the significance of study parameters between the two groups of subjects. Paired 't' test was used to test the effects of therapy within each group. A P value of <0.05 is considered significant. The Statistical software namely SPSS 15.0, Stata 8.0, Med Calc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

RESULTS: The mean age of subjects in Group A and B were similar (42.9±5.34 and 42.5±6.98 years respectively). There were 32 males (18 and 14 in Group A and B respectively) and 28 females (12 and 16 in Group A and B respectively).

There was a significant decrease in the pain intensity, as assessed by VAS in both groups at the end of 8 weeks, when compared to baseline (p=000; Table 1).

	Visual analog scale Score*		
	Group A	**Group B**	**P-Value**
Day 1	7.03±0.77	7.37±0.86	0.112 (p>0.05, hence not significant)
Week 4	4.30±0.79	4.73±0.64	0.024 (p<0.05, hence significant)
Week 8	1.60±0.56	2.23±0.57	0.0001 (p<0.001, hence extremely highly significant)
*All values presented as Mean±Standard deviation (SD)			

Table 1: Comparison of pain intensity between group A and group B

There was a significant improvement in the range of movement, as assessed by Modified Schober's Test in both groups at the end of 8 weeks, when compared to baseline (p=0.0001; Table 2).

	Modified-Modified Schober's Test Score*		
	Group A	**Group B**	**P-value**
Day 1	12.23±1.33	12.70±1.34	0.17 (p>0.05, hence not significant)
Week 4	18.10±1.16	17.97±1.19	0.66 (p>0.05, hence not significant)
Week 8	21.73±1.02	20.47±1.04	0.0001 (p<0.001, hence extremely highly significant)
*All values presented as Mean±Standard deviation (SD)			

Table 2: Comparison of MMST between group A and group B

Functional disability had significantly improved at the end of treatment, assessed at Week 8, compared to baseline (p=0.001 in both groups).

	Modified Oswestry Disability Questionnaire		
	Group A	**Group B**	**P-value**
Baseline (day 1)	43.85±8.43	51.75±9.40	0.001 (p<0.005,hence very statistically significant)
End of treatment (Week 8)	13.63±4.11	18.67±3.51	0.0001 (p<0.001, hence extremely highly significant)
*All values presented as Mean±Standard deviation (SD)			

Table 3: Comparison of MODQ between group A and group B

DISCUSSION: This study was intended to find and compare the effects of abdominal strengthening exercises with SWD with that of spinal extensor strengthening with SWD in reducing the pain and improving the functional ability in patients with chronic low back ache with 8 weeks of intervention.

Low back ache which was considered an ancient curse is now known as a modern international epidemic. It is one of the most common health concerns affecting around 65-80% of the population globally, at some time during their lifetime.[17]

There were totally 32 males and 28 females included in this study. However, previously it has been observed that the incidence is higher in females (70.3 per 1000 population), when compared to males (57.3 per 1000 population).[18] Low back pain is commonly affects people in the working age-group of 30-50 years.[8] Therefore, in our study, we included subjects only in this age group.

Shortwave diathermy is an effective deep heating modality of physical treatment for pain relief in chronic low back pain. Continuous SWD helps to relieve pain and muscle spasm, increase range of movement and decrease joint stiffness.[11] Shortwave diathermy for a duration of 20-30 min using coplanar method, at an intensity of application which is sufficient to cause a comfortable warmth to the patient is beneficial in chronic low back pain cases for pain relief. It has been suggested that SWD sessions can be carried out either daily or on alternate days.[19] In the present study, capacitive method[13, 20] of application, using pad electrodes with proper spacing by suitable material was used. The electrodes were equal in size but larger than the treatment area.[11] The electrodes were positioned in a coplanar manner over the dorsal lumbar region parallel to skin surface adjacent to the spine, as suggested in literature.[11,19] In our study, like previously suggested, subjects were given SWD for a duration of 20-30 min.

Exercise therapy is a key element of management of chronic low back pain. In a Cochrane review, exercise therapy was demonstrated to be an effective treatment to relieve the pain and to improve the functional status of patients with chronic low back pain.[20] In another recent meta-analysis, a beneficial effect for strength/resistance and coordination/stabilisation exercise programs over other interventions was observed in the management of chronic low back pain.[21] Core stability is defined as the ability of the lumbopelvic hip complex to prevent buckling (pelvic tilt) and to return to equilibrium after perturbation.[22] Core stability exercises, which focus on strengthening the trunk region, are an important component of rehabilitation for low back pain,[23,24] and are associated with better outcomes compared to general exercise.[25] Hodges proposed that improved control and stability would reduce the mechanical irritation and lead to pain relief in chronic low back ache.[8]

In our study, we compared the effects of exercising the two groups of core muscles, that is, abdominal and back muscles in low back pain.

We used three parameters to assess the effectiveness of therapy: pain intensity, assessed by VAS,[14] functional disability, assessed by MODQ[15] and ROM assessed by MMST.[16]

Visual analog scale is a widely used pain rating scale which consists of a horizontal line measuring 10 cm, which has a marking at every cm from 0 to 10, where 0 indicates no pain, and 10 indicates pain of maximum severity. Subjects were asked to rate their pain intensity from 0 to 10 based on the VAS.

The MMST was used for range of motion assessment of lumbar flexion. This test has moderate validity but excellent reliability and minimum metrically detectable change.[26] It is a reliable method for measuring lumbar flexion and extension for patients with low back pain.[16]

Self-reported measurements of disability are used to assess treatment outcomes in patients with low back pain.[27] The Oswestry Low Back Disability Questionnaire is one such tool, which was first described in 1980, after pilot testing on 25 subjects.[29] Modified versions of this questionnaire have been used in different studies.[15,30] We used one such modified version developed by Fritz et al. to assess functional disability in our study subjects. Here, subjects are asked to answer simple questions and the disability score is calculated.[15] Fritz et al. in their study, concluded that the MODQ was more reliable and responsive in low back pain patients than Quebec low back disability scale.[15]

There was a significant improvement in all three parameters at the end of the study, when compared to baseline (Tables 1, 2 and 3). Treatment in Group A was significantly more effective compared to that in Group B.

In conclusion, the findings of this study demonstrates that both abdominal and spinal extensor strengthening exercises, in combination with shortwave diathermy are associated with significant improvement in chronic low back pain. However, the limitations of our study are (i) there was no control arm, which received only SWD, (ii) sample size was small, (iii) study subjects were only in the age-group of 30-50 years, (iv) study included only patients with degenerative lumbar spondylosis and mechanical low back pain, and not those with any other condition and (v) the duration of low back ache was not equal for all the subjects.

Therefore, we opine that inclusion criteria must be more relaxed, to assess the applicability of these treatment regimens in chronic low back pain due to varied etiologies. Additionally, a larger trial including a control arm, should be conducted.

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Date of Submission: 19/03/2015.
Date of Peer Review: 20/03/2015.
Date of Acceptance: 28/03/2015.
Date of Publishing: 02/04/2015.