Effect of Supervised Endurance Exercise of Trunk Extensor Muscles in Chronic Low Back Pain among Young Adult Males

Md. Mahfuzur Rahman[1*] Imam Shariar[2] Abdul Mannan[3] Aminiddin A Khan[4]

Abstract

Background: Decreased endurance of trunk extensors is a significant risk factor for Low Back Pain (LBP). Clinicians treating low back pain often use exercise to reduce pain and improve function.

This study evaluated the effectiveness of supervised trunk extensor endurance training in reducing pain and decreasing disability in subjects with chronic LBP.

Materials and methods: This clinical trial included 92 patients with chronic LBP from the department of Physical Medicine & Rehabilitation, Chittagong Medical College Hospital, from July to December 2017. Patients were randomly assigned to either an experimental group (n=46) or a control group (n=46). Subjects in the experimental group attended supervised trunk endurance exercise sessions three times weekly for six weeks, but subjects in the control group performed exercises at home without supervision. A Visual Analogue Scale (VAS) for pain assessment and Sorensen Test was used to measure trunk extensor endurance. Reassessments were carried out at 3 and 6 weeks.

Results: Mean scores of the Sorensen test in the initial, 2nd & 3rd visits were 122.1±22.2, 127.0±13.5 & 126.6±18.5 respectively, in the experimental group, which were 123.2±8.2, 121.4±6.9 & 122.0±5.5 in the control group. There was no statistical difference ($p>0.05$) in 1st & the 2nd visit, while 2nd & the 3rd week significantly improved in the experimental group than the control group ($p<0.05$). The mean score of VAS was 4.07±1.70, 2.87±1.34 & 2.11±1.23 in the 1st, 2nd & 3rd visits, respectively, in group A. But in Group B which were 4.48±1, 3.59±1 & 3.54±1.35.02 in 1st, 2nd & 3rd visit respectively. The pain was significantly decreased in the experimental group after the 2nd and 3rd visits compared to the control group ($p=<0.001$). A negative correlation was found between the VAS and Sorensen test in every visit in both groups, indicating that improved back extensors' endurance resulted in decreased pain.

Conclusion: This study demonstrated the beneficial effect of supervised trunk extensors endurance exercise on chronic LBP, reducing pain and increasing endurance.

Key words: Back extensor endurance; Chronic low back pain; Trunk endurance exercise.

1. Assistant Professor of Physical Medicine & Rehabilitation Marine City Medical College, Chattogram.
2. Consultant of Physical Medicine & Rehabilitation Chittagong Medical College Hospital, Chattogram.
3. Medical Officer of Physical Medicine & Rehabilitation Marine City Medical College Hospital, Chattogram.
4. Professor of Physical Medicine & Rehabilitation Marine City Medical College, Chattogram.

***Correspondence: Dr. Md. Mahfuzur Rahman**
Cell : 01819 00 53 80
E-mail: emailtomahfuz@gmail.com

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Introduction

LBP is a very common health problem worldwide and a major cause of disability - affecting performance at work and general well-being.[1] It is needless to mention about the financial burden and disabilities imposed by the LBP. Hence, interventions towards the modifications of risk factors are warranted. Several risk factors are responsible for generation of LBP and trunk extensor muscles weakness is important one. Poor endurance of the trunk muscles may induce strain on the passive structures of the lumbar spine, leading eventually to low back pain. Evidence suggests that muscle endurance is lower for people with LBP than for individuals without LBP.[2,3]

The first test for evaluating the isometric endurance of trunk extensor muscles was described by Hansen in 1964. In 1984, following a study by Biering-Sorensen, this test became known as the "Sorensen test" and gained considerable popularity as a tool reported to predict LBP within the next year in males. Using the Sorensen Test as a measure of spinal extensors endurance, some researchers have found a difference in holding time between subjects with chronic LBP and individuals without LBP. [4,5] These findings seem to suggest that poor trunk extensor endurance is associated with prolonged or recurrent LBP.

The endurance of the trunk muscles may be related to LBP as this causes muscle fatigue and fatigue can affect the ability of people with LBP to respond to the demands of an unexpected load.[6]

Fatigue after repetitive loading also leads to a loss of control and precision, which may predispose an individual to developing LBP.[7] Therefore, trunk muscles endurance exercises has been recommended to elevate fatigue threshold and improve performance, thus reducing disability.[8,9]
In Bangladesh, although many people in the community have been suffering from chronic LBP, not much work has done in this field. In a study in Bangladesh show that back muscle strengthening exercises seemed to improve the patients with chronic LBP, but a paucity of information present in our country regarding relation of trunk muscle endurance with LBP in young adults.[10] This study attempted to investigate the effectiveness of supervised trunk extensor endurance training in reducing pain and decreasing disability in subjects with chronic LBP in young adult as they are productive population and can contribute a lot for the nation.

Materials and methods

A randomized controlled trial were conducted in the Department of Physical Medicine and Rehabilitation, Chittagong Medical College Hospital, Chattogram, Bangladesh from July 2016 to December 2016. Ethical approval for the study was obtained from the Ethical Review Committee of Chittagong Medical College and written informed consent was obtained from the participants.
Male patient with chronic LBP, age 18-45 years, attending Outpatient Department of Physical Medicine and Rehabilitation, CMCH were included. Patient with red flag signs of low back pain, inflammatory back pain, uncontrolled medical conditions (e.g., Diabetes mellitus, Hypertension, Asthma, Heart diseases) Structural spinal defects (e.g. Spondylolisthesis, Spondylolysis) signs of nerve root compromise (e.g. decreased tendon reflexes, sensory loss, motor deficits) were excluded.
Sample size was determined by using the formula to test they hypothesis of difference between two means. purposively. Considering 17.6 mean difference in the soreness test score between two groups with 95% confidence interval and 80% power, sample size of 46 was required in each group.
After consenting patients were randomly divided into two groups-Experimental and control group. Experimental group received conservative treatment+supervised trunk endurance exercise and control group received conservative treatment +non supervised trunk endurance exercise training at home. Exercise program was demonstrated and supervised by a trained and certified physiotherapist.

Trunk extensors endurance exercise consisted of 3 levels.[11] The 1st level consisted of bilateral shoulder lifts in a prone position, 2nd level consisted of contralateral arm and leg lifts in prone position, and 3rd level required both the shoulder and leg lifts in a prone position. Exercise was given 3 times per week.

Patients were followed up at 3rd, 6th week and the outcomes were recorded in the assessment data sheet from the first visit. Further data collected from each patient in every visit. Sorensen test score and visual analogue scale score for pain was assessed at base line and each follow-up visit.[5,12] Severity of pain was leveled by using VAS as mild (Score 1-3), moderate (Score 4-6), severe (Score 7-10).

Data were analyzed by using SPSS version 20.0. for Windows. The result presented in tables in mean, standard Deviation (SD) and percentages. Student's 't' tests, Chi-square test were done as required to see the level of significance. Pearson's coefficient test was done to correlate between variables. A "p" value <0.05 considered as significant.

Results

Equal no of patients were recruited in each group and all follow up data evaluable for all patients (No loss to follow up). At baseline both the groups were comparable in terms of their clinical and laboratory features (Table I). Regarding X-ray findings of lumbosacral supine, straightening of lumbar lordosis were most common findings 26(56.5%) and 31(67.4%) in experimental and control group, respectively. Second common findings were osteophyte formation along the periphery of the adjacent vertebral bodies 11(23.9%) and 9(19.6%) in experimental and control group, respectively. Narrowing of the intervertebral space 6(13.0%) in experimental and 4(8.7%) in control Group B. There is no significant difference of X-findings between two groups ($p> 0.05$).

Table I Clinical characteristics of the patients at baseline by study groups

Variables	Study groups		
	Experimental (n=46)	Control (n=46)	p value
Age, Years	32.28±7.23	30.09±7.64	0.160
BMI category			
18.5-24.9 kg/m^2	34 (73.9)	26 (56.5)	0.191*
25.0-29.9 kg/m^2	8 (17.4)	15 (32.6)	
30.0-34.9 kg/m^2	4 (8.7)	5 (10.9)	
Comorbidity			
None	29 (63.0)	18 (39.1)	0.148*
Diabetes mellitus	7 (15.2)	5 (10.9)	
Hypertension	4 (8.7)	13 (28.3)	
Ischemic heart disease	6 (13.0)	3 (6.5)	
Pain onset			
Sudden	10 (21.7)	12 (26.1)	0.625*
Insidious	36 (78.3)	34 (73.9)	
Pain intensity			
Mild	27 (58.7)	23 (50.0)	0.703*
Moderate	15 (32.6)	18 (39.1)	
Severe	4 (8.7)	5 (10.9)	
Pain characteristics			
Constant	8 (17.4)	11 (23.9)	0.439*
Intermittent	38 (82.6)	35 (76.1)	
Biochemical findings			
Hemoglobin, gm/dl	13.09 ± 2.02	13.41±1.26	0.101†
ESR, mm in 1st hr	14.13±5.22	12.80±1.44	0.369†
	6.63 ± 0.65	6.95 ±0.71	0.112†

Data were expressed as wither mean ±SD or frequency (%), Experimental group: Conservative treatment + supervised training, Control group: Conservative treatment + non-supervised training. *Chi-square test, †Unpaired student t-test. ESR: Erythrocyte Sedimentation Rate, FBS: Fasting Blood Sugar, SD: Standard deviation.

Table II shows outcome of patient assessed by Sorensen test. The mean score of Sorensen test in initial visit, 2nd visit on 3rd week and 3rd visit on 6th week were 122.1±22.2, 127.0±13.5 and 126.6±18.5 in experimental group. The corresponding values were 123.2±8.2, 121.4±6.9 and 122.0±5.5, respectively in control group. Baseline and visit on 6th week between two groups were not statistically difference (p> 0.05), while 2nd visit on 3rd week significantly improved in experimental group than control group (p<0.05).

Table II Outcome of the study patients according to Sorensen test (n=92)

Time of assessment	Mean±SD soreness test score		
	Experimental (n=46)	Control (n=46)	p value†
Baseline	122.1±22.2	123.2±8.2	0.757
Visit on 3rd week	127.0±13.5	121.4±6.9	0.014
Visit on 6th week	126.6±18.5	122.0±5.5	0.113

Experimental group: Conservative treatment + supervised training; Control group: Conservative treatment + non-supervised training. †Unpaired student t-test. SD: Standard Deviation, Significant value was in bold face.

Table III shows outcome of patient assessed by VAS. The mean score of VAS before treatment were 4.07±1.70 and 4.48±1 in experimental and control Group, respectively. The mean score of VAS in 3rd weeks after treatment were 2.87±1.34 and 3.59±1.02 in experimental and control Group, respectively (p=0.005). The mean score of VAS in 6th weeks after treatment were 2.11±1.23 and 3.54±1.35 in experimental and control Group, respectively (p=<0.001). Pain significantly decreased in experimental group after 2nd visit in 3rd week and 3rd visit in 6th week compared to control group.

Table III Outcome of the study patients according to VAS pain score

Time of assessment	Mean ± SD of VAS pain score		
	Experimental (n=46)	Control (n=46)	p value†
Initial visit	4.07±1.70	4.48±1.36	0.203ns
Visit on 3rd week	2.87±1.34	3.59±1.02	0.005s
Visit on 6th week	2.11±1.23	3.54±1.35	<0.001s

Experimental group: Conservative treatment + supervised training, Control group: Conservative treatment + non-supervised training. †Unpaired student t-test. SD: Standard Deviation, Significant value was in bold face.

Table IV depicted that, pain for VAS score decreased as the Sorensen score increased. The negative correlation between VAS score and Sorensen test score was significant statistically.

Table IV Correlation of VAS pain score and Sorensen test in 1st, 2nd & 3rd visit

Sorensen test value		VAS at presentation	VAS at 3rd visit	VAS at 6th visit
Baseline	r value	-.517**	-.304**	-.106
	p value	<.001	.003	.313
At 2nd visit	r value	-.404**	-.439**	-.342**
	p value	<.001	<.001	<.001
At 3rd visit	r value	-.542**	-.420**	-.387**
	p value	<.001	<.001	<.001

r= Correlation coefficient.

Discussion

This study was conducted to evaluate the effectiveness of supervised trunk extensors endurance on chronic LBP in a group of young adult male. All patients were managed by conservative treatment like Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) hot moist compression, ADL (Activities of daily living) advice. In addition, experimental groupo received supervised trunk endurance exercise three times weekly for 6 weeks and control group performed unsupervised training at home. Evaluation made at initial visit and at third and sixth week. Due to random allocation both the groups were similar in terms of their demographic, clinical, biochemical, and radiological characteristics.

In this study outcome of patients were assessed by Sorensen test and VAS score. The mean score of Sorensen test in initial visit and 6th week visits were similar. Only, the score in 3rd week visit was significantly higher in experimental group. These findings indicated that endurance training of the trunk extensors increased muscle endurance in short term (i.e., up to 3 weeks) and reduced pain in the long term (i.e., up to 6 weeks) in subjects with chronic LBP. But in long term there is no significant difference in endurance of trunk extensors between supervised and non-supervised group, which was agreed to the findings of Matarán-Peñarrocha et al.[13]

The mean difference of VAS score for pain was similar in both groups at baseline, but significantly lower in the experimental group than the control group in subsequent follow-up visits at 3rd week and 6th week. The results of our study differ from those of studies in which no improvements were found following exercise intervention.[14,15] The exercise program in these studies consisted of flexion and extension mobility exercises. This exercise program was different from the program of extensor endurance exercises used in our study. Bronfort et al and Maul et al found some positive effects of their exercise programs on pain and function.[16,17] In these studies, exercises or activities that trained the trunk muscles were encouraged. Thus, muscle rehabilitation may have been more important than simple mobilization exercises in improving function at the chronic stage of LBP.

In current study a negative correlation is found between VAS and Sorensen test at initial, 1st visit, and 2nd visit in both groups, which indicates that improvement of endurance of back extensors resulting in decreasing of pain. In a study Moffroid et al. also found same correlation with a non-back pain control group.[11]

Both the groups were comparable in terms of biochemical findings (Hb%, ESR).So no confounding effects of biochemical findings was found on outcomes in this study.

Limitation

This study was performed in a tertiary hospital, patients who were attended and received management mainly from urban area. This study done among the young males only, there is no information about the female gender.Follow up period was short, so it was not possible to comment on long term effect.

Conclusion

This study demonstrated a positive effect of trunk extensors endurance exercise on chronic LBP, which proved that trunk extensors endurance training effective in reducing pain and increasing endurance in patients with chronic LBP. The effect is significant when exercises performed under supervision.

Recommendation

Because the effectiveness of endurance training of the trunk extensors was demonstrated, we suggest that future studies should evaluate the effectiveness of a program incorporating early muscle reconditioning followed by task-specific training and workplace integration. However, further multicenter studies are required with larger sample size to validate the results.

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Contribution of authors
MMR-Conception, acquisition of data, data analysis, drafting & final approval.
IS-Acquisition of data, interpretation of data, drafting & final approval.
AAK-Design, interpretation of data, critical revision & final approval.

Disclosure
The authors declared no conflicts of interest.

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