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Effect of William Exercise and Blackburn Exercise in Patients with Chronic Low Back Pain: A Randomized Control Trial

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ABSTRACT

Background: Low back pain (LBP) physiotherapy treatment, mostly focuses on low back area and lower limb. Fewer physiotherapists and studies correlate the upper back and LBP. The present study was conducted to see the effect of lumbar stabilization (William) exercise and scapular stabilization (Black burn) exercise in chronic low back pain (CLBP) patients.
Methods: Total 28 subjects were allocated randomly by the lottery method in two different treatment groups, Group-A (William exercise + black burn exercise group) and Group-B (William exercise). Pain intensity was measured by numeric pain rating scale (NPRS), and functional disability score by Roland - Morris disability questionnaire (RMDQ). Statistical analysis was done using SPSS V.20.
Result: Within group analysis showed statistically significant difference in NPRS score($Z = -3.320$, $p < 0.001$), RMDQ score($Z = -3.300$, $p < 0.001$) in group A. Whereas NPRS score ($Z = -3.341$, $p < 0.001$), RMDQ score ($Z = -3.202$, $p < 0.001$) in group B. Comparison of baseline data showed no statistically significant difference in NPRS score ($U=89$, $p=0.668$) and RMDQ score ($U=84$, $p=0.518$) in both the groups. At the end of 4 weeks of intervention, data showed statistically significant difference in NPRS score ($U=51.5$, $p=0.024$) and RMDQ score ($U=52.5$, $p=0.035$) between both the groups.
Conclusion: This study concludes that William exercise is good for the CLBP patients but William exercise and Blackburn exercise shows superior results in pain reduction and also reduced back related disability and restored functioning in CLBP patients.

Keywords: Low back pain, William exercise, Scapular stabilization, black burn exercise

INTRODUCTION

Chronic low back pain (CLBP) is defined as a pain that persists for more than 3 months, or longer than the expected healing period; it represents one of the most common and costly musculoskeletal problems in modern society. CLBP is experienced by 70%–80% of adults at some time in their lives.[1] Most surveys conducted in different countries conclude that 80% of the world population had at least one LBP episode and that the 20% remaining have forgotten about it or have not paid attention to it. As people grow older, the risk of having back pain increases, mostly after the age of 40. Most episodes of back pain are short and do not affect daily life. Recurrences are common, representing

14% of all those who have had multiple episodes of back pain.

A study shows that LBP does not cure by itself. Treatment varies from conventional methods (physiotherapy, massage, chiropractic care, acupuncture.) to modern methods like ozone therapy, but the objectives are the same: pain control, disability prevention, resuming of suppressed daily activities and work. Applying an appropriate treatment is important given the duration of flares and the relapses rate. [2]

The William exercises were proposed by Dr. Williams. The purpose of exercises was to reduce pain and to ensure stability of the lower trunk by toning the abdominal muscles, buttocks, and hamstrings, altogether with the passive extent of hip flexors and sacrospinalis muscles. The aim of toning the abdominal muscles and back extensors, is to achieve a neutral position of the pelvis and to create an abdominal pressure capable of taking some of the pressure placed on the lower lumbar intervertebral discs. Getting a neutral position depends upon stretching the extensor lumbar muscles (paravertebral muscles and iliopsoas) and toning the abdominals (which pull the up) and the buttocks (which pull down the posterior part of the pelvis).

Blackburn exercises, originally introduced as rotator cuff strengthening exercises, are being modified and widely used to strengthen scapular rotator muscles. The exercises consist of sustained contractions of scapular retractions with the upper – limb position theoretically allows preferential activation of specific retractor muscles, and therefore results in varying scapular movements. [3]

Low back pain physiotherapy treatment mostly focuses on low back area and lower limb. There are few studies that correlate the upper back and low back pain. Therefore, in this study to treat low back pain patients, we aimed to treat low back area as well as give scapular stabilization exercise. Present study was conducted to see the effect of lumbar stabilization (William) exercise and scapular stabilization (Blackburn) exercise in chronic low back pain patients.

MATERIALS & METHODS

This randomized controlled trial study was held in out- patient departments at College of Physiotherapy, Ahmedabad from September 2022 to November 2022. Participants were allocated William exercise + Blackburn exercise protocol (Group A) and William exercise protocol (Group B) using a lottery method. All volunteers in two groups received one session of treatment daily. The outcome measures were assessed before and at the end of the 4 weeks of interventions. All participants were informed about assessment and intervention procedure and gave consent forms before research involvement. In case of refusing to continue for any reason and in any stage, the participant and relevant information were excluded from final analysis.

Sample size estimation was 28, using the following formula

$$2\left[\frac{(\sigma)2}{(\Delta)2}\right](Z\,\alpha + Z\ 1-\beta)^{2}$$

Where, σ = standard deviation is 7.4 based on pilot study.

Δ = Critical difference is based on pilot study.

Z α = 1.96 (95% confidence level)

Z β = 0.84 (statistical power of 80%)

Total 28 subjects were included in the study. The inclusion criteria were age between 40 to 60 years old, male or female having low back pain last 3 months with flexion bias and not having any neurological disturbance. Those patients who were referred for physiotherapy treatment by orthopedics. The exclusion criteria were patients with any contraindication to physical exercise including evidence of nerve root compromise (i.e., reflex, or sensation deficits), serious spinal pathology (example: tumors, fractures, inflammatory and/or infectious diseases), patients with any previous back surgery, previous

shoulder surgery, thoracic and/or shoulder girdle pain, patients with congenital musculoskeletal deformity, serious cardiovascular, neurological and metabolic diseases, pregnancy related low back pain, doing exercise regularly related low back pain or fitness, low back pain due to Leg limb discrepancy.

The outcome measures used were numerical pain rating scale (NPRS) and Roland - Morris disability questionnaire (RMDQ). Patients were asked to circle the number between 0 and 10 that fits best to their pain intensity. Zero usually represents 'no pain at all' whereas the upper limit represents 'the worst pain ever possible. NPRS has shown high correlations with other pain-assessment tools in several studies. The feasibility of its use and good compliance has also been proven. [4] The RMDQ is a 24-item patient-reported outcome measure that enquires about pain-related disability resulting from LBP. Items are scored 0 if left blank or 1 if endorsed, for a total RMDQ score ranging from 0 to 24; higher scores represent higher levels of pain-related disability. Typical RMDQ test–retest estimates are in the range of 0.79 to 0.88 points for relative reliability (intra-class correlation). [5]

Subjects were allocated in two different treatment groups, Group-A (William exercise + Blackburn exercise group), Group-B (William exercise) consisting of 14 subjects in each group. A therapist not involved in the intervention and data collection did the randomization by simple random sampling (lottery method) and allocated the subjects in two groups. Another therapist who was unaware of the group allocation did the physical assessment and collected data for all the outcome parameters at baseline, post intervention. The assessor did not reveal group allocation to the treating therapist. Baseline data for pain intensity during activity were assessed by numerical pain rating scale (NPRS) & functional disability score by Roland - Morris disability questionnaire (RMDQ) were assessed and collected at pre-intervention. Total 20 treatment sessions were given to each subject with the frequency of 5 sessions per week for 4 consecutive weeks. After completing the therapeutic session, post- intervention data of the outcome parameters were taken. The following ergonomic advice were given to all the subjects – showing step-by-step correct technique of getting up from bed, proper weight carrying technique, correct postural habits while working in kitchen and during driving, maintaining a proper posture in chair, avoid excessive squatting, prolonged crossed-leg sitting, lifting heavy objects, avoid fatiguing postures except for infrequent short durations tasks, change posture frequently and use support where possible and avoid giving excess strain to the back.

The groups were given the following exercises -

Group A: William exercise + Blackburn exercise protocol

Group B: William exercise protocol

WILLIAM EXERCISES:
Pelvic Tilt: Lie on your back with knees bent, feet flat on the floor. Flatten the small of your back against the floor without pushing down with the legs. Hold for 5 to 10 seconds.
Single knee to chest: Lie on your back with knees bent and feet flat on the floor. Slowly pull your right knee toward your shoulder and hold 5 to 10 seconds. Lower the knee and repeat with the other knee.
Double knee to chest: Begin as in the previous exercise. After pulling the right knee to chest, pull the left knee to chest and hold both knees for 5 to 10 seconds. Slowly lower one leg at a time
Partial sit up: Do the pelvic tilt and, while holding this position, slowly curl your head and shoulders off the floor. Hold briefly. Return slowly to the starting position.
Hamstring stretch: Start in a long sitting with toes directed toward the ceiling and knees fully extended. Slowly lower the trunk forward over the legs, keeping knees extended, arms outstretched over the legs and eyes focused ahead.
Hip Flexor stretch: Place one foot in front of the other with the left (front) knee flexed and the right (back) knee held rigidly straight. Flex forward through the trunk until the left knee contacts the axillary fold (armpit

region). Repeat with right leg on and left leg back.
Squatting: Stand with both feet parallel, about shoulder's width apart. Attempting to maintain the trunk as perpendicular as possible to the floor, eyes focused ahead, and feet flat on the floor, the subject slowly lowers his body by flexing his knees.

BLACKBURN EXERCISE: [6]

These exercises are scapula stabilization exercises. The exercise method consists of six movements and is a bilateral exercise that strengthens the muscles around the scapula by lifting the arm from the prone position.

BLACKBURN EXERCISES:

A: Prone Horizontal Abduction (Neutral): Lie on the table, face down, with arms hanging straight down to the floor and palms facing down. Raise arms out to the side, parallel to the floor. Hold for 2 seconds and lower slowly.
B: Prone Horizontal Abduction (Full ER): Lie on the table, face down, with arms hanging straight to the floor, and thumbs rotated up (hitchhiker position). Raise arms out to the side with slightly in front of the shoulder, parallel to the floor. Hold for 2 seconds and lower slowly.
C: Prone Horizontal Scaption (Neutral): Lie on the table, face down, with arms hanging straight down to the floor and palms facing down. Raise your arms to the side but slightly forward by about 30° compared to horizontal abduction. Hold for 2 seconds and lower slowly.
D: Prone Horizontal Scaption (Full ER): Lie on the table, face down, with arms hanging straight to the floor, and thumbs rotated up (hitch-hiker position). Raise your arms to the side but slightly forward by about 30° compared to horizontal abduction. Hold for 2 seconds and lower slowly.
E: Prone Horizontal External Rotation: Lie on the table, face down, with arms abducted horizontal to side and elbows bent 90° pointing down. Rotate arms externally so that forearms come parallel to ground point forward. Hold for 2 seconds and lower slowly.
F: Prone Horizontal Extension: Lie on the table, face down, with arms hanging straight down to the floor and palms facing forward. Raise your arms to the horizontal parallel of the thorax. Hold for 2 seconds and lower slowly.

Exercise progression is shown in table 3. After four weeks, the post treatment score was taken.

Table 3: EXERCISE PROGRESSION:

Weeks	Frequency
1st week	4 repetitions/each exercise
2nd week	6 repetitions/each exercise
3rd week	8 repetitions/each exercise
4th week	10 repetitions/each exercise

Statistical Analysis Data analysis was done using statistical package for the social sciences (SPSS) version 20 and Microsoft Excel 2007. Prior to statistical tests, the data was screened for normality. Shapiro-Wilk test was used to check normality. Data of all the outcomes were not normally distributed in both groups so a non-parametric test was used for analysis. Within group analysis of the difference in mean for NPRS , RMD questionnaire in group A and group B was done using non-parametric test ─ Wilcoxon signed Rank test. Between group analysis of the difference in mean for NPRS , RMD questionnaire in group A and group B was done using a nonparametric test ─ Mann-Whitney Test. The tests were applied at 95% confidence interval on p-value set at <0.05.

RESULT

Flow of participants through the study: 58 subjects having CLBP were screened. 36 fulfilled the inclusion criteria and were recruited for the study. 2 subjects found the department too far from their residence & 2 went out of town in the middle of treatment, 4 subjects did not come for regular treatment. Thus 8 dropped out from the study & remaining 28 completed the treatment protocol.
Table 4 shows the descriptive statistics of age and gender distribution among 28 subjects in both groups.

Table 4: Descriptive statistics of age and sex distribution in both groups.

Group	N	Mea ± SD of age	Male	Female
Group A: (William exercise + Blackburn exercise)	14	51 ± 6.26	6	8
Group B: (William exercise)	14	49.86 ± 6.10	6	8
Total	28	50.43 ± 6.18	12	16

Within group analysis showed statistically significant difference in NPRS and RMDQ. [Table 5,6]

Table 5: Mean difference in NPRS within groups

Group	Pre-treatment	Post-treatment	Z value	p value
Group A	5.43±1.02	2.07±0.83	-3.320	0.001
Group B	5.14±1.41	3±1.18	-3.341	0.001

Table 6: Mean difference in RMDQ within groups

Group	Pre-treatment	Post-treatment	Z value	p value
Group A	14.71 ±3.10	5.57±2.77	-3.300	0.001
Group B	13.57±3.57	8.43±3.82	-3.202	0.001

Comparison of baseline data which shows that there is no significant difference in both the groups [Table-7]. Comparison of end of 4 weeks intervention data which shows that there is statistically significant difference in both the groups [Table 8]

Table 7: Comparison of baseline data of both the groups

Outcome measure	Group A (Mean ± SD)	Group B (Mean ± SD)	U value	P value
NPRS	5.43±1.02	5.14±1.41	89	0.668
RMDQ	14.71 ±3.10	13.57±3.57	84	0.518

Table 8: Comparison of end of 4 weeks intervention data of both groups

Outcome measure	Group A (Mean ± SD)	Group B (Mean ± SD)	U value	P value
NPRS	2.07±0.83	3±1.18	51.5	0.024
RMDQ	5.57±2.77	8.43±3.82	52.5	0.035

DISCUSSION

The present study showed statistically significant within group differences in NPRS score and RMDQ scores in Group A and Group B. At the end of 4 weeks of intervention, data showed that there is statistically significant difference in both the groups. There is statistically significant difference between NPRS and RMDQ scores between Group A and Group B.

Yundari AI et al found that William exercises significantly reduce the pain intensity. They concluded that William exercise is recommended to reduce low back pain. [7] Fatemi R et al found that 8 weeks of William exercise led to significant decreases in LBP. They concluded that William corrective training was considered as a useful and valid method for restoring and refining back deformities in lumbar areas. In present study there is statistically significant difference between RMDQ scores (pre score and post score) in Group A and Group B. [8] Prayugo MH et al found that RMDQ score decreases in physiotherapy students by Williams Exercises. They concluded that William flexion exercises yielded significant effect in managing chronic non-specific low back pain in undergraduate physiotherapy students. [9]

In present study William Exercise and Black burn Exercise was superior to William Exercise alone. The William Exercise and Black burn exercise protocol also proved to be of great effect when it came to the treatment of chronic low back patients. According to the closed kinetic chain

concept, distal segment movements are influenced by the proximal segment stability through a connection in the control of body segments. Trunk musculature can act in the stabilization, transfer, and anticipation for the functional performance of the upper limbs because they are related to the scapulothoracic muscles. The anatomical and functional relationship between the trunk and scapulothoracic muscles may be also explained by the Anatomical Trains Theory, which deals with the existence of a myofascial interaction in the same functional chain. [10]

In present study NPRS and RMDQ scores in Group A (William exercise + Black burn exercise group) was less than Group B (William exercise group). Toro et al. demonstrated that conscious activation of the abdominals induces an increase in the electromyographic activity of the scapulothoracic muscles. Similarly, Maenhout et al. identified that different positions of the lower limbs while executing push-ups provide improvements in the EMG activity of the periscapular muscles, and this seems to be at least partly explained by the transmission of forces from the extensor muscles of the trunk.

In the present study, the occupation of patients was not analyzed. Medical conditions were not taken in detail. Our recommendations are to conduct further studies with long duration of intervention for the investigation of long-term effects of both interventions in chronic low back pain patients.

CONCLUSION

The present study concludes that William exercise is good for the chronic low back pain patients but added Blackburn exercise (scapular stabilization exercise) shows superior results in pain reduction and reduced back related disability and restored functioning in chronic low back patients. According to present study clinically scapular stabilization exercise is more beneficial for low back pain patients.

Declaration by Authors

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