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A 4 week core stability exercise programme using swiss ball, theraband and floor exercises in cricketers with low back pain: a randomised clinical trail

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ABSTRACT

Introduction

Low back pain (LBP) is one of the most common complaints seen in primary care, with 60-85% of adults experiencing it at some time in their lives. Current studies have done to see the effect of core strengthening exercises using Swiss ball, theraband and floor exercises in general population with low back pain, but there are no studies which have compared the effectiveness of Swiss ball, theraband and floor exercises in core strengthening in cricketers with low back pain.

Objective

To study and compare the effectiveness of Swiss ball exercises, theraband exercises and floor exercises in cricketers with low back ache in terms of pain and back strength.

Study design

Randomized Clinical Trial

Methods

Sixty competitive cricket players between the ages 18 to 35 years were randomly assigned to 1 of 3 groups. Group A –Swiss Ball Exercises (n=20), Group B - Theraband Exercises (n=20) and Group C - Floor exercises (n=20). Baseline pain and back strength was taken pretreatment i.e. 1st day and post treatment i.e. 4th week. VAS was used to assess pain and Pressure Bio feedback was used to measure the back strength in cricketers with low back ache. Comparison of data within group and between groups of the pre and post values was done.

Results

The results revealed that within group analysis in all the three groups showed statistically significant improvement in terms of pain and back strength ($p<0.001$). Whereas when between groups was analyzed, Group B (theraband) showed significant improvement when compared to Group A (Swiss ball) and Group C (floor) showed significant improvement when compared to Group C.

Conclusion

Although the study showed beneficial results in all the 3 groups, but the results reflected that theraband group had better improvement than the other two groups which was measured in terms of strength improvement and pain reduction.

Keywords: Swiss Ball, Theraband, Pressure Biofeedback, Cricketers, Low Back Pain

INTRODUCTION

Low back pain (LBP) is one of the most widely recognized symptoms in the developed world, yet its origins are among the most subtle. It very well may be incredibly impairing, and the social and economic burden is huge [1]. Back pain was once known as an old revile and is currently known as an advanced global pandemic. LBP (LBP) is defined as pain experienced between the twelfth rib and the inferior gluteal folds, with or without associated leg pain [2]. Low back pain (LBP) is one of the most widely recognized complaints seen in Physiotherapy centers, with 60-85% of adults encountering it eventually in their lives. Athletes are no special case, with the additional strain of a long training period adding to the issue, particularly in adolescents, [3] and up to 75% of elite athletes experience back pain [4]. In young adults, intervertebral discs are solid to the point that it first harms the adjoining bone after a traumatic injury [5]. Quick bowlers have a far higher rate of spondylolysis (11-55%) than everybody (5%). Another lumbar pathology discovered usually in cricketers incorporates pedicle sclerosis, spondylolisthesis, accelerated disc degeneration, and muscular soft tissue injury. There is an unmistakable relationship between bowling with a mixed side/front-on action and stress fractures of the pars inter-articularis. The correction of the technique brings about a decrease of injury inside one year of its execution. Different components that have been demonstrated to be related to stress fractures are landing on an extended knee; an exorbitant workload of bowling (over's per match and games per season); and poor foot structure, (fallen longitudinal arches). Unfortunately, studies are not available to directly link the correction of these factors to a reduced incidence [6]. As expressed in Cricket Australia Injury Report 2003 on Australian cricketers, it was demonstrated that the rate of LBP was 8%, and as high as 14% among fast bowlers [7]. The core has been alluded to as the "powerhouse," the foundation or engine of all limb movements. A comprehensive strengthening or facilitation of these core muscles has been upheld as an approach to prevent and restore the different lumbar spine and musculoskeletal disorders and as an approach to enhance athletic performance. The vertebral column is bolstered by a global and local stabilizing system provided by Queensland research group. The Swiss ball has become an acknowledged therapeutic apparatus in physiotherapy centers as well as among sports medicine personals and those trying to advance a healthy lifestyle. Swiss balls have been consolidated into strength training and promoted as the way to all the more adequately trains the musculoskeletal system. Performing strength exercises on Swiss balls has been pushed on the conviction that a labile surface will give a greater challenge to trunk musculature, increment the dynamic balance of the athlete and potentially train athletes to balance out their spines to prevent and treat injury [8]. Perceived as the original system of progressive resistance for more than 25 years, and embraced by the American Physical Therapy Association (APTA), Theraband elastic resistance has been demonstrated to increase strength, mobility, and function, as well as reduce joint pain. Evidence-Based exercise programs using Theraband and tubing rehabilitating injuries, improve the functional capacity in adults, and improve athletic performance.

The utilization of elastic resistance products in therapeutic exercise programs has widespread in rehabilitation and has been demonstrated to be effective strategies for giving resistance and improving muscle strength [9]. Studies have been proposed that effective use of elastic bands for resistance training requires the use of biomechanical standards as well as an understanding of the physical properties of elastic resistance material. Exercise therapy was more successful than expected consideration by the general practitioner and equally effective as traditional physiotherapy for chronic low back pain and might be useful for chronic low back pain patients to build come back to activities of daily living and work [10] (the evidence reviewed

included all types of exercises such as specific back exercises, abdominal exercises, flexion, extension, static, dynamic, strengthening, stretching or aerobic exercises). The key point is to improve the performance of muscles following up on the lumbar spine to prevent hurtful movement. A review of the evidence recommends those with more prominent ranges of spine movement experience increased risk of future difficulties and that endurance, not strength, is related to diminished symptoms [11]. Very little has been published about the effectiveness of Swiss Ball, Theraband, and Floor Exercises in Cricketers with Low Back Ache. Studies have shown the efficacy of Swiss Ball, Theraband, and Floor Exercises individually, but there are no comparative studies between these three techniques. Hence the present study is designed to determine the effectiveness of three exercise therapy interventions such as Swiss Ball, Theraband, and Floor Exercises on a range of back strength and pain in participants with the low backache in cricketers. The objectives of the present study were to determine and compare the efficacy of Swiss ball exercises on core stabilization in cricketers with low back pain in terms of pain and strength

MATERIALS AND METHODS

Design

Following the KLE institute of Physiotherapy Ethics Committee approval (reference number 01/09/05), we carried out a randomized clinical trial with written consent from all participants between March 2011 and February 2012.

Participants

The sixty (60) cricketers were randomly allocated to three groups of twenty (20) each and were recruited from 3 sporting academies from Belgaum city with symptoms of low backache involved in competitive sport. Inclusion criteria were; low back pain of more than 12 weeks duration, without leg symptoms or neurologic signs; being 18 – 35 years of age; Pain on Visual Analogue Scale > 5; ability to give informed consent. Subjects were excluded if they had a history of trauma, associated neurological symptoms, Injuries of the lower limb, acute low backache.

Outcome measures

The primary outcome was pain and strength. The pain was assessed utilizing the Visual Analogue Scale (VAS). Participants were asked to mark on the horizontal line; 100 mm in length, anchored by word descriptors at each end that they feel represents their perception of their current state. The participants were asked to mark the intensity of pain on a 10 cm long line marked with numbers 0 to 10 where 0 represents no pain and 10 represented maximum pain. The VAS score was determined by measuring in millimeters from the left-hand end of the line to the point that the subject marks [12].

The strength was measured using the Pressure Biofeedback (PBF) device. The device consisted of three-chamber pressure cells which were placed under the lumbar spine in crook lying and inflated to a baseline of 40mmHg. The participant was asked to draw in the abdominal wall without moving the spine or pelvis. Pressure should remain at 40mmHg (i.e. no movement of the spine). Participants were instructed to hold it for 10 seconds, breathe normally, and are repeated 10 times. The measuring range is 0-200 mmHg analog pressure with an accuracy of +/- 3 MHz pressure [13].

Interventions

All participants will be screened for their inclusion and exclusion criteria before their recruitment within the study. Written informed consent was obtained from the study participants and was randomly allocated to 3 groups: Group A (Swiss Ball Exercises), Group B (Theraband Exercises), and Group C (Floor Exercises) using envelop method.

Treatment consisted of abdominal curl exercise, back extension exercise, pelvic bridge exercise and side bridge exercise in Group A, theraband loop abdominal crunch exercise, theraband loop abdominal oblique crunch exercise, theraband tubing long-sitting back extension and theraband loop trunk side bending in Group B and Abdominal crunches, Back extension, Side bridge, Oblique crunches in Group C. all the exercises were performed once a day for 4 times per week with 10 repetitions and a 10-second hold. The outcome measures of pre and post treatment were subjected to statistical analysis for significance.

STATISTICAL ANALYSIS

Statistical analysis for the present study was done using the statistical package of social sciences (SPSS) version 14 to verify the results obtained. For this purpose, data were entered into an excel spreadsheet, tabulated, and subjected to statistical analysis. Various statistical measures such as mean, standard deviation, and test of significance such as paired and unpaired t-test were used. Nominal data from patient's demographic data i.e. age, sex, BMI, Ht, Wt distribution were analyzed using ANOVA t-test. Comparison of the pre-intervention and post-intervention outcome measures within the group was done by using Paired t-test, Wilcoxon matched-pairs test was applied whereas ANOVA, Kruskal-Wallis test was utilized to measure the difference between two groups (Intergroup comparison) in terms of decrease in Visual Analogue Scale (VAS) and Pressure Biofeedback (PBF) values. Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

RESULTS

There were no significant differences in age, body weight, and height and body mass index of the participants. The participant's characteristics are presented in table 1.

Table 1: Comparison of Groups in terms of Age, Height, Weight and BMI

Group	Age (years)		Height		Weight		BMI	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
A	21.1	1.92	171.3	6.03	62.2	5.62	21.17	1.46
B	21.2	2.07	173.9	3.64	64.45	5.75	21.28	1.98
C	20.5	1.19	170.55	5.46	61.45	3.59	21.20	0.98
F value	0.918		2.335		1.884		0.025	
P value	0.405		0.106		0.161		0.975	

OUTCOME MEASURES

Visual analogue scale score

In Group A, the mean VAS score on pre-session as in the first session was 6.4 ± 0.8, which was reduced to a mean of 3.6 ± 1.2 after 16 sessions of treatment. The p-value by paired t-test was found to be < 0.001 which is highly significant. (Table no. 2)

In Group B, the mean VAS score on pre-session as in the first session was 6.3 ± 1.0, which was reduced to a mean of 2.9 ± 1.3 after 16 sessions of treatment. The p-value by paired t-test was found to be < 0.001 which is highly significant. (Table no. 2)

In Group C, the mean VAS score on pre-session on the first session was 6.2 ± 0.7, which was reduced to a mean of 404 ± 0.7 after 16 sessions of treatment. The p-value by paired t-test was found to be < 0.001 which is statistically significant. (Table no. 2)

Table 2: Comparison of Pain Scores within Group A, Group B and Group C

Groups	Pre Treatment		Post Treatment		W, t* value	P value
	Mean	SD	Mean	SD		
Group A	53.3	6.9	67.5	8.5	-210	<0.001
Group B	56.6	7.9	73.1	8.9	9.95*	<0.001
Group C	52.9	7.4	62.3	7.2	-210	<0.001

On comparing the pain scores as on VAS in all the groups, which was 2.8 ± 1.08 decrease of pain in Group A, 3.34 ± 1.11 in Group B and 1.18 ± 0.75 in Group C. The results between the three groups using ANOVA showed that there is a highly significant difference between group A, group B, and group C at 5 % level of significance. Therefore, we conclude that group B is better than Group A, Group A is better than C, and Group B is Better than Group C in terms of pain reduction as on VAS. (Table 3)

Table 3: Comparison of Differences between means Obtained for VAS of Groups A, B and C

	Group A	Group B	Group C	F value	P value
Mean	2.80	3.34	1.81	12.128	<0.001
SD	1.08	1.11	0.75		

PRESSURE BIOFEEDBACK

In Group A, the mean of back strength on pre-session as in the first session was 53.3 ± 6.9, which was increased to a mean of 67.5 ± 8.5 after 16 sessions of treatment. The p-value by 'Wilcoxon' matched pairs test was found to be < 0.001 which is highly significant. (Table 4)

In Group B, the mean of back strength on pre-session as in the first session was 56.6 ± 7.9, which was increased to a mean of 73.1 ± 8.9 after 16 sessions of treatment. The p-value by 'Wilcoxon' matched pairs test was found to be < 0.001 which is highly significant. (Table 4)

In Group C, the mean of back strength on pre-session on the first session was 52.9 ± 7.4, which was increased to a mean of 62.3 ± 7.2 after 16 sessions of treatment. The p-value by 'Wilcoxon' matched pairs test was found to be < 0.001 which is highly significant. (Table 4)

Table 4: Comparison of strength As On PBF Within Group A, Group B And Group C

Groups	Pre Treatment		Post Treatment		W, t* value	P value
	Mean	SD	Mean	SD		
Group A	53.3	6.9	67.5	8.5	-210	<0.001
Group B	56.6	7.9	73.1	8.9	9.95*	<0.001
Group C	52.9	7.4	62.3	7.2	-210	<0.001

On comparing the difference between means obtained for back strength of all the three groups which was 14.2 ± 5.11 increase in back strength in group A, 16.35 ± 7.62 in group B and 11.4 ± 6.46 in group C. The results between three groups using Kruskal-Wallis test showed that there is a significant difference between group A, group B and group C al 5 % level of significance. Therefore, we conclude that Group B is better than Group A, Group A is better than Group C and Group B is Better than Group C in terms of back strength as on Pressure Biofeedback. (Table 5)

Table 5.Comparison of Differences between means obtained for PBF of Groups A, B and C

	Group A	Group B	Group C	KW value	P value
Mean	14.2	16.35	11.4	6.19	0.045
SD	5.11	7.62	6.46		

DISCUSSION

The present study showed improvement in all the experimental groups when compared to their baseline values. However, theraband group was statistically significant when compared to the swiss ball and floor exercise groups whereas the swiss ball group had better improvement than the floor exercise group in terms of pain and strength of core musculature.

The improvements found in the Swiss ball group is in assent with the study done by Vera- Garcia, F.J (2000) who contemplated abdominal muscular strength response during curl-ups on steady and labile surfaces breaking down electromyographic signals inferred that performing curl-ups on a swiss ball changes both the degree of muscle activity and the way that the muscles co- activate to stabilize the spine recommending higher demand on the motor control system which they concluded might be alluring for desirable for specific stages in the rehabilitation procedure. They indicated that more muscle activation and co- contraction of trunk flexor and extensor muscles were evoked [14]. The present study was supported by an empirical study by Marshal and Murphy in 2005 who used Swiss ball as a mode of intervention in low back pain patients for a duration of 12- weeks. Researchers found evidence that this modality of exercise may successfully improve the functional capacity of patients with chronic non-specific lower back pain and attribute the reduction in disability to the improvement in the flexion relaxation response of the erector spinae. However, the study did not include a control group to conclude that swiss ball exercises would be more effective than performing those exercises on a stable surface [15].

Hughes (1999) in his study showed the benefits of using theraband for the strengthening of shoulder musculature because it is easy to use, safe for all population to employ, low cost and portability and hence the present study also agree with the previous researches as the participants in theraband group were more comfortable and compliant [9].

Anderson, Rush, Shearer, and Hughes in 1992, reported a ten percent increase in the strength of the internal rotators of the shoulder of young subjects after six weeks of training with Thera-Band. The results of the present study of the theraband group also demonstrated the same i.e. improved strength in terms of pressure biofeedback results [16]. Triber FA (1998) made a study to determine the effect of a 4- week isotonic resistance training program using theraband elastic tubing and light-weighted dumbbells on concentric shoulder rotator strength or velocity of services or both in a group of elite-level tennis players. Male and female varsity college tennis players were randomly assigned to control group for 4-week training. The experimental group exhibited significant gains in internal rotation torque at both slow and fast speeds & also in external rotation torque at fast speed. Another benefit provided by the fact that elastic resistance does not rely on gravity is that it provides continuous tension to the muscles being trained [17]. When you lift a free weight like a dumbbell in any direction other than straight up and down, the tension on the muscle can be removed at certain points in the range of motion. Another unique benefit of elastic resistance that free weight resistance does not offer is linear variable resistance. The clinical implication is suggestive of as the range of motion of the exercise increases, the resistance provided by the elastic equipment increases. However, benefits of this is that as the range of motion increases and the resistance increases, the number of muscle fibers that are being used in the exercising muscle increase. The more the muscle fibers used, the greater theadaptations in muscle strength that can be achieved with the training program. These changes can be presumably associated with the strength gains and benefits in pain reduction in the present study. Axler, Craig T, Mcgill, Stuart M proposed a study which investigated various abdominal exercises that optimize the challenge to the abdominal muscles (rectus abdominis, external oblique, internal oblique) but would impose minimal load penalty at the lumbar spine and concluded with no single exercise was found that would optimally train all of the abdominal muscles while at the same time incurring minimal intervertebral joint loads. It also concluded that a variety of abdominal exercises are required to sufficiently challenge all of the abdominal muscles and that these exercises will differ to best meet the different training objectives of individuals [18]. The present study agrees in terms of pain of athletes with nonspecific low back pain of meta-analysis in the systematic review by Edwin Choon Wyn Lim who concluded that Pilates-based exercises are superior to minimal intervention for reduction of pain in individuals with nonspecific low back pain. The individuals with nonspecific chronic low back pain in most of the studies received 8 to 12 of Pilates-based exercises at a frequency of 1 to 2 times per week over 6 to 8 weeks. Since the study is closely related to the Pilates approach of rehabilitation with a frequency of 4 sessions per week for 4 weeks, the improvement can be credited to Pilates-based exercises [19].

The limitations of the current study were absence of control group, the study did not consider number of years in sports and long term follow up.

CONCLUSION

Three different types of active physiotherapy produced clinically important improvements in health state in this challenging patient group. Physiotherapist-led pain management, combining with structured simple exercises of back aimed at reducing pain and improving strength in cricketers with low back pain. Although the study showed beneficial results in all the 3 groups, but the results reflect that theraband group had better improvement than the other two groups which was measured in terms of strength improvement and pain reduction.

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