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Research Article

The Effects of a Daily Short Duration Mobility and Exercise Program on Individuals with Chronic Low Back Pain: A Pilot Study

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ABSTRACT

Purpose: Low back pain has been a well-researched topic and it is estimated to affect nearly 82% of Americans at some point in their life. The purpose of this study was to determine whether the effects of a daily short duration mobility program produce significantly different results in pain and disability when compared to the same amount of brisk daily walking.

Methods: A randomized control trial of 15 participants with a primary complaint of chronic low back pain for at least three months were assigned to a walking group (N=5) or a dynamic stretching group (N=10). All participants received 5 outcome measures: Visual Analog Scale (VAS), Fear Avoidance Behavior Questionnaire (FABQ), Pain Catastrophizing Scale, SF-36 and Oswestry Disability Index (ODI). Subjects placed into the walking group were asked to walk at a brisk, self-selected pace for 12 minutes at least 5 days a week. Brisk was defined as at least a 4 on a 0-10 RPE scale. Participants in the mobility group were instructed in a 12 minute stretching program, which they were also asked to perform at least 5 days a week. Mobility group participants were provided a YouTube link with the stretching program. Both groups were given accountability logs and were contacted once a week to ensure adherence. Subjects performed the walking or mobility programs for 3 weeks after which they were re-evaluated using the same criteria as used in the initial evaluation. Alpha level ≤ 0.05 was selected for significance for all comparisons.

Results: The stretching group showed significantly improved scores related to the FABQ (p=0.019) and the Pain Catastrophizing Scale (p=0.026) when compared to the walking group. Additionally, significant differences were noted in the stretching group for VAS (p=0.011), ODI (p=0.017), SF-36 Energy/Fatigue (p=0.047), SF-36 Pain (p=0.027) and SF-36 General Health (p=0.041).

Conclusion: In conclusion, a daily short duration mobility and exercise program was more effective than walking in decreasing fear avoidance behavior and pain catastrophizing in subjects with chronic low back pain.

Clinical Relevance: This study is clinically relevant given that it demonstrates prescription of a mobility program may be more beneficial than a walking program for patients with chronic low back pain. Additionally, this study supports the use of a telehealth application in the treatment of chronic low back pain.

INTRODUCTION

Chronic pain is a debilitating healthcare issue effecting many individuals throughout the world with the most common condition being chronic low back pain (cLBP) [1]. For low back pain to be considered a chronic condition, it must be present for >3 months. In the United States cLBP currently holds a one-year mean prevalence rate of 38.1% and a systematic review conducted in 2015 found the prevalence of back pain to be 19.6% in individuals between the ages of 20 and 59 years old increasing linearly from the third to sixth decade of life [1,2]. In addition to the detriment of living life in pain, the population suffering from spinal issues also faces a financial burden, paying an average of $4,695 in medical fees per year compared to their pain-free counter parts average of $2,731 [3].

Sedentary lifestyle factors are likely contributing to common impairments associated with LBP including poor core or glute

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strength [4,5] poor hip and spinal mobility [5-8] or postural dysfunction. Although it is well known a sedentary lifestyle correlates with a variety of issues including cLBP [9,10], the NIH states many factors deterring Americans from exercising daily include poor adherence, and a lack of time, motivation and access to resources.

Although a large variety of treatment options exist for individuals with cLBP, opioids are often the first line of treatment and are prescribed in over 70% of LBP cases because they provide an acute analgesic effect [11]. While the analgesic effect can be beneficial for short-term pain, opioids may not provide long-term relief as past research shows opioids do not improve the daily functioning in someone with LBP [12]. Based on current Centers for Disease Control and Prevention (CDC) data, opioids are displaying a rapid increase in deaths and abuse (CDC). The National Institute of Health (NIH) states that nearly 130 people die each year from the abuse of opioids with an estimated financial burden of $78.5 billion per year (NIH). While opioids provide pain relief, it may prove to be beneficial to develop more alternative modes of conservative treatment for chronic LBP.

A current alternative method for treating cLBP is implementing mobility programs such as yoga. Yoga has demonstrated to be beneficial on individuals with mild to moderate cLBP [13]. Yoga has been proven to have both short and long-term relief of cLBP and research supports its use in managing pain and dysfunction associated with LBP [13,14]. However, Chang et al. explains yoga required a time commitment which ranged from 30 to 90 minutes, ranging from weekly to twice-weekly sessions [15]. The time commitment and relatively high cost of yoga classes increase the likeliness for poor adherence and often individuals of higher socioeconomic status are capable of participating [16]. An area of research lacking evidence for the treatment and prevention of cLBP is the use of a daily full-body mobility program as a way to save time and money while decreasing pain and increasing function. Hurley et al. found a progressive walking program to be an effective treatment option for the management of cLBP [17]. Walking proved to be a comparable and effective option to manage chronic LBP due to the low cost and increased level of adherence [17].

The etiology of LBP is complex and multifactorial in nature, making it difficult to determine the most effective and efficacious plan of care for each patient [18,19]. Therefore, the aim of this study is to investigate a potential treatment option for a variety of individuals with cLBP that also mitigates common barriers to exercise.

METHODS

Recruitment

Potential participants were contacted via email through Franklin Pierce University DPT program in Goodyear, Arizona and a local physical therapy clinic contact database (Impact Physical Therapy). Those who responded as interested were then added to our contact list. Screening then took place via phone by four DPT student researchers.

Participants

Seventy four adults with chronic low back pain were contacted via phone and those that met the inclusion criteria were invited to participate in the study. Our study then consisted of a sample size of 15 adults (8 males, 7 females) with a mean age of 34 years of age (mean=34.77). This study was approved by the Institutional Review Board (IRB) under the protection of human subjects by the Declaration of Helsinki.

Inclusion Criteria

This study included adult participants between the ages of 18-65 years old with self- reported LBP for a minimum of three months. Participants were excluded if they were currently participating in physical therapy or any form of mobility program. Participants were excluded if they had complaints of any radiating pain or numbness, tingling or burning past the knee that was greater than a 5/10 conducted via numeric pain rating scale, had complaints of severe hip pain or any recent shoulder, elbow or hand pain as this could be exacerbated by positions in the stretching routine. Additionally, subjects must have denied any uncontrolled cardiac pathologies, recent changes in bowel and bladder function, orthostatic hypotension with exercise or changes in position and dizziness or vertigo. Eligible participants did not have any systemic diseases or disorders, did not demonstrate or report any cognitive deficits or mental health illness and were not pregnant. Finally, our participants were not to have had any surgeries in the past six months, falls within the past one year or previous history of a spinal fusion.

Initial Assessment

Participants were initially assessed by a licensed Doctor of Physical Therapy (DPT). Upon arriving to the appointment, each participant signed a written informed consent, filled out an intake form (including a brief medical history, a body chart and a visual analog scale for pain ranging from 0-10) and completed four outcome measures: Fear Avoidance Belief Questionnaire (FABQ), Oswestry Disability Index (ODI), Pain Catastrophizing Scale and SF-36).

Fear Avoidance Belief Questionnaire: The FABQ is a valid and reliable outcome measure that was chosen to examine how fear-avoidance beliefs may effect a person's pain [20-23].

Oswestry Disability Index: The ODI is a valid and reliable outcome measure used to examine severity of symptoms of LBP with activities of daily living (ADLs) [24-26].

Pain catastrophizing: The Pain Catastrophizing Scale is a valid and reliable outcome measure used to assess patients to indicate subjective thoughts or feelings they have about their pain [27,28].

SF-36: The SF-36 is a valid and reliable outcome measure that includes 36 items encompassing eight categories including physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain and general health [29].

Randomization and Procedure

The study design was conducted as a randomized control trial with a convenience sample. Participants were randomly assigned to either a dynamic stretching group (DSG) or a walking group (WG) via a random number generator prior to their initialassessment.

Vital signs including pulse rate, SPO_2 and blood pressure, were taken on each participant in compliance with ACSM guidelines to safely engage in exercise. Blinded to the group selection for each individual, two doctors of physical therapy (DPT) performed preliminary mobility and pain provocation screens of each participant. Active range of motion (AROM) of thoracolumbar

and hips were obtained and any pain by the participant was noted. Following randomization and initial assessment, participants in each group met with a physical therapy student who provided standardized verbal and visual instruction in the respective group protocol. Both groups were instructed to perform their respective routine at least five days a week for three weeks. Subjects were given a log to document their activity [30]. Subjects were instructed to stop activity and notify their student contact if their pain increased from baseline. Student researchers followed up with each subject at least once per week via the participant's preference of email, text or phone call to ensure exercise adherence.

Walking Group Protocol

Participants in the WG were given an RPE scale and instructed to walk 12 minutes at a self-selected moderate intensity, correlating with a 4-6/10 on the RPE scale (ACSM) [31,32]. Individuals were given the option to walk on a treadmill or outdoors.

Dynamic Stretching Group Protocol

DSG participants were provided access to a private YouTube link containing the short duration dynamic stretching routine. Each subject performed the routine in full at the end of their assessment appointment while being supervised by a student physical therapist to ensure proper form. The dynamic stretching exercises used in the patient video are listed in Table 1 titled Dynamic Stretching Exercises.

Final Evaluations

At the conclusion of the three-week intervention, subjects were provided the same outcome measures as the initial assessment via email to complete on the last day of their routine. Participants were then scheduled at their convenience to return to the testing facility for re-assessment. During this re-assessment, the physical therapists repeated initial mobility and pain provocation tests, and the subjects were able to submit the completed outcome measures. Participants were evaluated by the same DPT as the preliminary assessment to ensure consistency across the participant experience.

Statistical Analysis

Statistical tests were performed via SPSS. Wilcoxon Signed-Ranks tests were performed to compare pre- and post-scores for each outcome measure for all participants. Kruskal Wallis test was performed to compare overall changes from the DSG to the WG. The level of statistical significance was set at ($P < 0.05$). An analysis of power was not performed due to our study design being a pilot study to show feasibility in preparation to plan a larger study in the future.

RESULTS

A total of 18 subjects were chosen to participate in the study after completing the phone screening; 15 subjects participated in the study (see withdrawal section below). The mean age of participants (N=15) was 34.77 years outcome measure responses pre and post

Table 1: Dynamic Stretching Exercises

Activity	Dosage
Warm-Up	
Lateral High Stepping in Place	12sec; 4 each side
Overhead Reaches	10sec; 5 each side
Side to Side Across-Body Reaches	5 each side
Lateral Side bending Overhead Reaches	3-5 count each side x 1
Star Reaches with Forward Stepping	6 on each side
Stationary Marches	4 each side
Hip Opener	4 each side
Stretching Routine	
Figure-4 Glute Stretch with Chair	8 reps each side with 10 count hold on the 8th rep
Modified Cat Cow with Straight arms on Chair	5 reps with a 5 count hold on the 5th rep
Lat Stretch on Chair with Crossed Legs	5 reps each side with a 5 count hold on the 5th rep
Forward Fold	20 sec, pedaling of feet with forward fold
Chaturanga	5 count
Downward Dog	20 sec with or without pedaling of the feet
Left Half-kneel Hip Flexor Stretch	20 sec
Left Half-kneel Hip Flexor Stretch with Left arm up and Lefttrunk rotation	10 sec
Downward Dog	10 sec
Right Half-kneel Hip Flexor Stretch	20 sec
Right Half-kneel Hip Flexor Stretch with Right arm up and Righttrunk rotation	10 sec
Cat Cow in Quadruped	3 reps
Seated Forward Fold	20 sec
Seated Glute Stretch with Trunk Rotation	20 sec each side
Child's Pose with Tented Fingers; Arms straight in front, to the Right, and to the Left	20 sec forward, 15 to the Right, 15 to the Left
Tall Kneel with OH Reaches andDeep Breathing	3 reps

Intervention for both the SG and WG are displayed in Table 2. There was no statistically significant improvement in the WG when comparing outcome measures pre and post intervention. However, the DSG experienced significant differences in VAS (p = 0.011), ODI (p= 0.047), SF-36 energy/fatigue item (p = 0.047), SF-36 pain item (p = 0.027) and SF-36 general health item (p=0.041). When comparing the change in outcome measures between the WG and DSG, a Kruskal-Wallis analysis found two outcome measures that were significantly different (p-value < 0.05). The DSG showed significantly improved scores related to FABQ (p=0.019) and the Pain Catastrophizing Scale (p=0.026). Table 2 quality of life outcome tool results lists the statistical data collected for each of the quality of life tools assessed pre and post.

Table 2: Quality of Life Outcome Tool Results

Variable	Dynamic Stretching Group (DSG)			Walking Group (WG)			Comparison
	Mean	SD	SIG Value	Mean	SD	SIG Value	NS
VAS (Scale, 0-10)							NS
pre	6.2	1.1353	0.011	6.6	1.3416	NS	
post	8	1.813		3.25	2.3639		
FABQ							0.019 (<0.05)
pre	6.3	5.478	NS	8.4	3.647	NS	
post	3.89	4.137		11	4.546		
ODI							NS
pre	15	7.577	0.017	21.6	14.311	NS	
post	8.57	9.572		11	8.718		
Pain Catastrophizing Scale							0.026(<0.05)
pre	9.2	7.525	NS	6.8	5.541	NS	
post	4.11	7.623		1	1.414		
SF36 Physical functioning							NS
pre	79	17.7639	NS	93	8.3666	NS	
post	88.75	12.7475		96.667	5.7735		
SF36 Role limitations due to physical health							NS
pre	72.5	41.5832	NS	70	31.0792	NS	
post	87.5	25.3553		91.667	14.4338		
SF36 Role limitations due to emotional problems							NS
pre	86.67	32.2008	NS	73.34	27.8966	NS	
post	95.838	11.7733		100	0		
SF36 Energy/Fatigue							NS
pre	55	16.6667	0.047	58	20.7966	NS	
Post	60.625	15.4554		76.667	10.4083		
SF36, Emotional well - being							NS
pre	74	10.5409	NS	70.4	19.718	NS	
Post	76	9.798		84	10.583		
SF36, Social functioning							NS
pre	85	17.4801	NS	80	22.7074	NS	
post	95.313	9.3003		100	0		
SF36, Pain							NS
pre	63.75	16.8428	0.027	63.5	9.7788	NS	
post	82.5	13.562		70.833	23.2289		
SF36, General health							NS
pre	75	14.5297	0.041	70	16.9558	NS	
post	83.75	15.2947		78.333	16.0728		

***NS=Not significant**

WITHDRAWALS

Three subjects did not complete the duration of the study. Two participants were dismissed due to not meeting the adherence requirement of performing their activity five times per week. One participant was deemed inappropriate at the initial evaluation secondary to concurrent physical therapy for hip pain.

DISCUSSION

Roughly one quarter of the American population suffers from back pain [1,2]. In addition, CDC data indicates activity levels are currently at an all time low in the United States and are trending downward. Extensive research has shown the benefits of physical activity on back pain and general health. However, minimal research has proven the benefits of a short duration daily mobility program in the treatment of cLBP.

Although general exercise, such as walking, is beneficial for a variety of conditions, this study revealed short bouts of walking may not be the most effective primary intervention for individuals with cLBP. The results indicate a mobility routine may be beneficial for adults with cLBP when compared with individuals performing the same duration of walking. Previous research has demonstrated daily walking to be effective in reducing pain and functional disability associated with cLBP [33]. This study differed in that subjects were not progressed per the ACSM guidelines for daily exercise. Adorno et al. found isometric stretching to be beneficial for improving quality of life in patients with cLBP, using the SF-36 outcome measure to quantify the subject's perceived improvement in quality of life [34]. The present study showed statistically significant improvements in the DSG using the SF-36 items of energy/fatigue, pain and general health.

In both study groups, statistically significant differences were seen in both the FABQ and Pain Catastrophizing Scale scores at follow-up. When compared with the WG, the DSG demonstrated greater significance in both the FABQ and Pain Catastrophizing Scale scores, suggesting dynamic stretching may be more beneficial for reduction in fear avoidance behaviors than walking alone. The greater benefits seen in the DSG may stem from tri-planar motion occurring when performing the specified movements. which in turn can result in abnormal spinal loading and often increased pain (2000) [35]. The mobility program utilized in this study encourages movement into all planes rather than moving primarily in the sagittal plane, which is typical during walking. Encouraging participants to move in a tri-planar, dynamic nature may contribute to decreased feelings of fear avoidance.

CONCLUSION

Pain and fear avoidance behaviors are two of the most common impairments associated with cLBP in addition to decreased quality of life. The results of this study suggest a short mobility routine may be superior to the same duration of walking for improving participants' perceptions of energy level, pain and general health. These results may be applied when determining appropriate home exercise prescription and dosing for patients with cLBP. This may aid in maximizing compliance and improving patient satisfaction.

LIMITATIONS

This study used a convenience sample with participants from Franklin Pierce University and former patients of a local physical therapy clinic. Although subjects filled out accountability logs demonstrating adherence totheir assignedprotocol, the researchers are unable to further verify subjects were fully adherent as they were not directly supervised by the research team. Although there were statistically significant changes in scores for some of the outcome measures, the sample size was a small convenience sample and thus cannot be generalized to the general population.

FUTURE RESEARCH

Future research is needed to duplicate these results with a larger sample size. Additionally, more research is necessary to determine the minimal time frame of a mobility program necessary to produce favorable outcomes for individuals with cLBP.

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