J. Phys. Ther. Sci.
24: 217–222, 2012

Effectiveness of Brief Education Combined with a Home-Based Exercise Program on Pain and Disability of Office Workers with Chronic Low Back Pain: a Pilot Study

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Abstract. [Purpose] This pilot study aimed to investigate the effectiveness of brief education combined with home exercise programs on pain and disability of office workers with chronic non-specific LBP. [Subject] A quasi-experimental study of single group, pretest-posttest design with 30 workers as subjects serving as their own controls was conducted. [Methods] Initially, demographic characteristics and outcome measures, including pain intensity using a visual analogue scale and the Roland-Morris disability score, were collected every 2 weeks for 6 weeks. Participants then received interventions for 8 weeks, consisting of brief education regarding LBP and individually designed home exercise programs, focusing on core stability, stretching and mobility exercises. After that, outcome measures were collected every 2 weeks for 6 weeks. [Results] Pain intensity and disability gradually decreased after completion of the interventions. However, pain intensity decreased to a significant level only after completion of the intervention for 4–6 weeks. No significant difference in disability level was found between pre- and post-intervention. [Conclusion] The combination of brief education and a home exercise program can alleviate the pain intensity of office workers with chronic non-specific LBP. Further research using a randomized controlled trial design is required to validate this preliminary finding.
Key words: Intervention, Therapeutic exercise, Quasi-experimental study

(This article was submitted Sep. 12, 2011, and was accepted Oct. 24, 2011)

INTRODUCTION

Low back pain (LBP) is common among office workers. Approximately 23% to 38% of office workers experience LBP[1-4)]. LBP imposes a significant burden on both the individual and society. Most people who develop LBP have persistent pain and associated disability for months and a small proportion even experience high-disability LBP[5, 6)]. In 2001, the total cost of LBP in Australia was estimated at 9.2 billion AU dollars[7)] whereas, in 2006, the total cost of LBP in the United States exceeded 100 billion US dollars[8)]. Thus, the development of effective interventions aimed at the management of LBP is urgently required.

There is a growing body of evidence suggesting that exercise therapy is beneficial for pain and disability reduction in patients with chronic non-specific LBP[9-12)]. Oesch et al.[10)] in their systematic review and meta-analysis of randomized controlled trials on the effectiveness of exercise on work disability of patients with non-acute non-specific LBP concluded that it remains unclear which type of exercise is the most effective for patients with non-acute non-specific LBP. Koes et al.[13)] reviewed international clinical guidelines for the management of non-specific LBP in primary care and found that most guidelines did not recommend a particular type of exercise for chronic non-specific LBP. The European guidelines for the management of chronic non-specific LBP advise cognitive behavioural therapy, supervised exercise therapy, brief educational interventions and multidisciplinary (biopsychosocial) treatment for chronic non-specific LBP[14)]. The biopsychosocial model of care for chronic LBP also identifies self-management as an integral component of effective management[15)].

LBP in different occupations is unlikely to originate from identical causes because patients are exposed to different biopsychosocial risk factors. Therefore, implementing the same exercise regimen for everyone with LBP, regardless of their occupations, would be irrational. Office work usually involves working on a computer. Accumulated computer usage has been linked to an increased risk of LBP[16, 17)]. Sitting for more than half a work day in combination with awkward postures or frequently working in a forward bent position has been found to increase the likelihood of having LBP[4, 18)]. To date, no evidence has been found for a specific type of exercise which is appropriate for office workers with chronic non-specific LBP. Previous studies have indicated that home-based exercise programs are as effective as supervised exercise programs[10)]. The purpose of this paper was to investigate the effectiveness of brief educational intervention in combination with home-based exercise programs on pain and disability of office workers with chronic non-specific LBP.

SUBJECTS AND METHODS

A convenience sample of office workers working in a university were invited to participate in this study. The inclusion criteria were: age of 18–60 years, full-time office workers with at least one year of experience in the current position, and LBP >3 months duration. The area of LBP was defined according to the standardized Nordic questionnaire[19]. The exclusion criteria were: ongoing treatment for LBP, women who were or had been pregnant in the past year, a history of intra-abdominal or femoral surgery in the past year, a history of spinal surgery, congenital deformity of the spine, LBP due to serious spinal pathology (e.g., tumor, fracture, dislocation or infection), systemic disease or other specific causes. The study was approved by the University Human Ethics Committee. A written informed consent was signed by all participants.

A quasi-experimental study of single group, pretest-posttest design with the subjects serving as their own controls was employed to evaluate the effectiveness of the brief educational intervention and home-based exercise programs. At the beginning of the study (observation 1), demographic characteristics and outcome measures were collected and repeatedly collected every 2 weeks for 6 weeks (observation 2–4). Subjects then received interventions for 8 weeks. After completion of the interventions, outcome measures were immediately collected (observation 5) and re-collected every 2 weeks for 6 weeks (observation 6–8). In total, the study took 20 weeks to complete and the subjects were requested not to seek any other treatment during the course of the study.

All subjects received the same intervention protocol, which consisted of brief education regarding LBP and a home-based exercise program, which was designed by a trained physical therapist. The LBP education used in this study was based upon “The Back Book”, which was written by Roland et al.[20]. The therapist verbally explained the contents to each patient in a single, half-hour education session. During the session, patients were encouraged to discuss and ask questions regarding the content.

To customize a home-based exercise program for each individual, subjects underwent a physical examination conducted by physical therapists according to a standardized protocol at the commencement of the study. The physical examination, focusing on spinal mobility and core stability, included assessment of spinal movement restriction using the Backache index[21] and McKenzie extension test[22], spinal scoliosis[23], spinal curvature using a flexicurve[24] and the core stability test[25]. The therapist then assigned exercises to each patient to perform daily at home according to the results of physical examination. Home-based exercises given to patients were categorized into 3 types: core stability, stretching and mobility exercises. In general, patients were instructed to perform each exercise by holding for 5–15 sec, repeating 5 times per set and performing 3 sets daily. The therapist taught patients how to perform exercises correctly and then provided patients with a brochure and a compact disc, which featured detailed illustrations of each exercise, for review. In addition, patients were given a diary to record the frequency of performing home-based exercises each day. During the intervention period, the therapist made appointments to see each patient once every two weeks for eight weeks (totally 4 visits) to collect the diary and encourage their exercise compliance. During the visits to the physical therapy clinic, the subjects sometimes received treatment, including hot packs, lumbar traction and/or electrotherapy, according to the physical therapist’s discretion. Each subject underwent the same physical examination immediately upon completion of the 8-week intervention session.

Before data collection, the reliability of the physical examination results was assessed for 21–31 office workers. Each subject was tested twice on two separate days with a one week lapse between the measurements.

Pain intensity at the times of measurement and in the past week were evaluated using a visual analogue scale of pain intensity (VAS-I). Disability level associated with LBP was assessed using the Roland-Morris Disability Questionnaire (RDQ). The RDQ contains 24 yes/no items. Patients are asked whether the statements apply to them that day (the last 24 hours). The RDQ score is calculated by adding up the number of “yes” items, ranging from 0 to 24, with higher scores indicating more severe disability[26]. Both outcome measures, which are commonly used in the clinical setting, have been found to provide reliable results in chronic LBP patients[27, 28].

For the reliability study, the intraclass correlation coefficient (ICC [1,1]), Kappa coefficient and Kappa coefficient with linear weighting were calculated for continuous, nominal and ordinal data, respectively.

Characteristics of the subjects participating in the study and exercise compliance were described using means or proportions. Comparisons of physical examination results between pre- and post-intervention were conducted using the paired-samples *t*-test for continuous data and Wilcoxon’s signed-rank test for nominal and ordinal data.

To determine whether each outcome measure varied over time (observation 1–8), one-way analysis of variance (ANOVA) was performed. When a significant difference was found in the ANOVA, Tukey *post hoc* comparison was employed to determine whether the two selected means were significantly different from each other. A *post hoc* calculation of the statistical power was also carried out. All statistical analyses were performed using SPSS statistical software, version 17.0 (SPSS Inc, Chicago, IL, USA) and a level of significance of 0.05 for all analyses.

RESULTS

A total of 51 eligible office workers agreed to participate in this study. Of these, 14 (27%) dropped out during the study. The reason given for dropping out was insufficient time to visit the physical therapy clinic due to work commitments. Office workers who completed the program but did not perform exercises at all (n=3) or performed exercises on average less than once a week (n=4) were also excluded from the study. Thus, the final analysis was based on data

Table 1. Characteristics of study population (n=30)

Characteristics	N (%)	Mean ± SD
Gender		
Male	6 (20.0)	
Female	24 (80.0)	
Age(years)		40.5 ± 6.8
Body mass index (Kg/m^2)		24.2 ± 4.2
Level of education		
Primary school	0 (0.0)	
Secondary school	1 (3.3)	
College	1 (3.3)	
Bachelor's degree	21 (70.0)	
Higher than Bachelor's degree	7 (23.4)	
Years of work experience (years)		11.9 ± 7.1
Weekly working days (days per week)		5.0 ± 0.6
Daily working hours (hours per day)		8.0 ± 1.2
Duration of low back pain		
≥ 3 months but < 7 months	8 (26.7)	
≥ 7 months but < 3 years	15 (50.0)	
≥ 3 years	7 (23.3)	

Table 2. Physical examination results of pre- and post-intervention (n=30)

Physical examination	Before	After
Lumbar stability test		
Level 0	1 (3.3)	0 (0)
Level 1	8 (26.7)	1 (3.3)
Level 2	11 (36.6)	23 (76.7)
Level 3	8 (26.7)	5 (16.7)
Level 4	2 (6.7)	1 (3.3)
Level 5	0 (0)	0 (0)
Level 6	0 (0)	0 (0)
Thoracic or lumbar scoliosis		
Yes	1 (3.3)	1 (3.3)
No	29 (96.7)	29 (96.7)
Spinal curve measurement		
TW:LW ratio	0.56 (0.68)	0.98 (1.51)
TL:LL ratio	0.85 (0.60)	0.94 (0.91)
Backache Index	3.0 (3.3)	1.8 (1.7)
McKenzie extension test		
Symptoms worsened	1 (3.3)	0 (0)
No change	17 (56.7)	18 (60)
Symptoms improved	12 (40)	12 (40)

collected for 30 office workers. The sample population comprised mainly middle-aged females with Bachelor's degrees and slightly above normal ranges of body mass index for Asians[29]. Their working time was typical of that for office workers (i.e. 8 hours per day, 5 days per week) with quite extensive working experience. The majority of participants had had LBP for more than 7 months (Table 1).

The results of the reliability study show the physical examination results had moderate (0.54) to very good (1.00) reliability[30]. The mean (SD) of exercise compliance was 33.3 (13.3) days, ranging from 13 to 56 days. There was no significant difference between pre- and post-intervention for any physical examination result (Table 2).

One-way ANOVA indicated a significant effect of time on VAS-I at the times of measurement ($F_{7,208}$ = 2.891, p = 0.007) and in the past week ($F_{7,208}$ = 3.529, p = 0.001). For the RDQ score, there was a marginally significant effect ($F_{7,208}$ = 2.079, p = 0.047). The *post hoc* Tukey test revealed that there were no statistically significant differences in VAS-I (both at the times of measurement and in the past week) and RDQ scores during the pre-intervention period (observation 1–4) (p>0.05). The VAS-I score at the times of measurement immediately before the intervention (observation 4) was significantly different from the score at 6 weeks after the intervention session (observation 8) (p<0.05). The VAS-I score in the past week immediately before the intervention (observation 4) was significantly different from the scores at 4 and 6 weeks after the 8-week intervention (observation 7–8) (p<0.05). The RDQ score did not significantly differ throughout the study (observation 1–8) (p>0.05).

The *post hoc* statistical power calculation revealed that the number of subjects who participated in this study (n=30) gave the study sufficient statistical power (80%) to detect the medium effect (f = 0.26–0.34)[31].

DISCUSSION

The present study is the first study to investigate the effectiveness of education and exercise on a specific group of the population with chronic LBP. The present study demonstrated that both pain and disability gradually decreased after office workers completed the 8-week intervention, which consisted of the combination of brief education regarding LBP and simple home-based exercise programs, focusing on core stability, stretching and mobility exercises. The results show that pain intensity decreased to a significant level only after completion of the intervention for 4–6 weeks. No significant difference in disability level was found between pre- and post-intervention.

The sample population in the present study had low pain intensity level (VAS-I scores ranging from 3.1–3.9/10) and very low disability level (RDQ scores ranging from 3.7–4.8/24). One explanation for these findings is that these office workers still continued their work and did not seek treatment during the period of the study. Workers who continue working will have low disability because it would be difficult for them to remain productive with high disability levels[32]. In cases of low impairment and disability, the European guidelines for the management of chronic non-specific LBP suggests that exercises, brief educational interventions and medication may be sufficient[14].

Before receiving the intervention, participants were followed for 6 weeks. The results show that both pain intensity and disability levels were not significantly altered, implying that the symptoms in our participants were stable. After receiving the intervention, the average improvement in pain intensity and disability seen over the 6-week period after completion of the intervention was 1.4 points or 42% for the VAS-I score at the time of measurement, 1.6 or 43% for the VAS-I score in the past week and 1.6 points or

45% for the RDQ score. Because the baseline scores were already low, it is possible that a 'floor effect' reduced their marginal value[31]. Nevertheless, Jensen[33] suggested that a decrease in VAS-I of between 26–41% may be considered meaningful by patients and a decrease in VAS-I of between 58-71% may be considered substantial by patients. Stratford et al.[34] suggested that the minimum clinically important change in scores for patients with little disability is 1-2 points. Thus, changes in both pain intensity and disability seen in patients after the completion of the intervention is considered to be of clinical relevance. However, the lack of statistical significance may be the result of insufficient power to detect small effects because of the small sample size. Thus, the combination of brief educational intervention and home-based exercise programs used in this study is a potentially effective intervention for office workers with chronic non-specific LBP, who have low levels of both pain intensity and disability.

It is unclear as to why significant reductions in pain intensity were noted only after some time following completion of the intervention. One explanation for such findings relates to exercise adherence. Evidence suggests that the effectiveness of exercise for patients with chronic LBP depends on their exercise adherence[35]. The results show that patients' adherence to the home-based exercise program was quite low (59%)[36]. Other studies investigating the effectiveness of exercise programs have had similar issues with exercise adherence[36, 37]. Furthermore, no changes in physical examination results were found between pre- and post-intervention, although a trend of improvement in the Backache index, which assesses spinal movement restriction, was noted after the intervention. These results may imply that an insufficient number of exercise sessions were performed or insufficient time was allowed to induce significant musculoskeletal changes. It is possible that a number of participants might have continued some of the home-based exercise programs prescribed to them after completion of the 8-week intervention period; however, this was not monitored. The results of this study may have been considerably different if exercise adherence had increased or a longer intervention period had been provided.

Interestingly, Ryan et al.[37], in their randomized controlled trial investigated the effect of pain biology education and group exercise classes compared to pain biology alone for patients with chronic LBP. They found that, in the short term, pain biology education alone had a significantly greater effect on pain and pain self-efficacy than a combination of pain biology education and group exercise classes. They attributed their findings to the results of either the interaction between pain biology education and exercise or the exercise alone. Therefore, if the subjects in the current study had discontinued the prescribed exercise after completion of the 8-week intervention period, the finding of reduction in outcome measures after that period may have reflected the negative effect of interaction between brief education and exercise or the exercise alone, as suggested by Ryan et al.[37].

Although exercise therapy is a well-established treatment for patients with chronic LBP[9, 11, 12], a recommendation as to which type of exercise is suitable for which population is less obvious[10]. The exercise program prescribed to patients in the present study included core stability, stretching and mobility exercises, which have previously been found to be effective for treating patients with chronic LBP[35, 38, 39]. However, in this study, we focused on stretching and mobility exercises because office work usually involves computer use and document work for long hours. Deconditioning from prolonged awkward positions, sustained posture and repetitive movement may lead to a reduction in the length of soft tissues, which would consequently limit the range of available motion in the joints[40, 41]. Limited joint motion will distort the normal body biomechanics, and such distortions can contribute to the risk of injury[41]. Previous research has shown that reduction of lumbar flexion increases the risk of developing low back pain in worker populations[42]. Adams et al.[43] reported that reduced range of lumbar lateral bending, a long back, and reduced lumbar lordosis were predictors of serious LBP. Stretching and mobility exercises essentially aim to promote the flexibility and extensibility of joints, muscles and muscle tendon units, thereby increasing the range of joint motion. Furthermore, stretching and mobility exercises encourage circulation and oxygenation in the joints, muscles and muscle tendon units[44]. In addition, in the current study, prescription of exercise was individually designed based on the individual physical examination results, and it took an individual's problems into account. Oesch et al.[10] recommended individually designed home-based exercises administered within a behavioural treatment approach to restore the function of patients with chronic LBP.

The limitations of the present study should be taken into consideration when interpreting its results. The primary limitation of this research is that the quasi-experimental nature of the study makes it vulnerable to temporal threats to internal validity. However, to demonstrate that the temporal effect was minimized in the current study, outcome measures were followed for 6 weeks before the start of intervention. No significant difference in outcome measures was detected during this pre-intervention period. In addition, as the majority of participants had a long history of LBP (over 7 months in 73% of participants), it is unlikely that the observed reduction in outcome measures after completion of the intervention was a natural process. Although the results show a clinically relevant reduction in outcome measures after receiving the intervention, we cannot determine the absolute effects of the intervention used in this study because no standardized control group was incorporated. Thus, the findings of the present study should be taken as a preliminary result. A randomized controlled trial is needed to validate the findings of this study. Second, the sample size was relatively small, increasing the likelihood of a type II error, although *post hoc* calculation of the statistical power based on 30 subjects indicated that the study had an 80% probability of detecting moderate effects. Last, the design of this study did not allow us to determine whether the observed reduction in outcome measures was the result of brief education, home-based exercise program or both. A previous study reported pain biology education alone had a significantly greater effect on pain intensity than a combination of pain biology education and group exercise classes for patients with chronic LBP[37]. Based on that study, we presume that the brief education used in this study alone is, at least, as effective as the combination of brief education and exercise program for treating office workers with chronic non-specific LBP. However, the exercise program used in the present study was dissimilar to that used in the previous study because it was individually designed. We expect the effectiveness of individually designed exercise program would be superior to a fixed exercise program. However, to better understand the effect of each therapeutic modality, a randomized controlled trial investigating the effectiveness of brief education, exercise program and the combination of brief education and exercise program is needed.

In conclusion, the results of the current study suggest that the combination of brief education regarding LBP and a simple and individually designed, home-based exercise program focusing on core stability, stretching and mobility exercises can alleviate pain intensity in office workers with chronic non-specific LBP. The rationale for this finding is not fully understood. This study proposes a promising effective exercise type that is suitable for office workers with low levels of both pain intensity and disability. Further research using a randomized controlled trial design is required to validate this preliminary finding.

ACKNOWLEDGEMENTS

This work was funded by the Thai Health Foundation and Chulalongkorn University Centenary Academic Development Project (#12). The authors wish to thank Ms. Wararom Kanchanasamut and Ms. Pawinee Harutaichun for their help with data collection.

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