



Comparing the Effectiveness of Two Direct and Indirect Training Programs on Teachers' Musculoskeletal Pain and Functional Disability in Savojbolagh City

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Background: Low back pain is one of the most common musculoskeletal diseases, so that 58-84% of the people in the community experience it once in their lifetimes. Teachers are among those who are at risk for the musculoskeletal disorders due to the type of their occupation. Therefore, it is essential to choose an appropriate training method for treatment and reduction of disability in this group. The aim of this study was to compare the effectiveness of two training methods in reducing pain and functional disability in this group of teachers.

Materials and Methods: In this experimental study, two questionnaires of VAS measure the pain level and Oswestry measuring the severity of functional disability were distributed among the 175 teachers with low back pain as pre-test. People were randomly divided into three groups: one control group with 35 participants and two experimental groups with 70 participants. One of the experimental groups was trained with lecturing and the other one with a tutorial video as a CD. Eventually, 6 weeks after the intervention, post-test was conducted.

Findings: The mean of pain and functional disability was not significantly reduced in the control group. But in the two intervention groups, there was a significant decrease in pain and functional disability. The pain intensity in face-to-face training group decreased from 5.13 ± 1.54 to 3.79 ± 1.76 and in video training group from 5.11 ± 1.57 to 2.63 ± 1.56 , indicating that the most pain reduction was in the video training group. The mean of functional disability was reduced in face-to-face training groups ((from 29.60 ± 10.97 to 20.74 ± 10.16 and in video training group from 33.06 ± 13.04 to 19.43 ± 12.47).

Conclusion: Indirect training method was more effective than direct training in reducing back pain. But in reducing functional disability, the type of training method did not produce significant difference in the degree of disability. Therefore, considering the cost and effectiveness of indirect training methods, it is recommended that these methods be used more for teachers' training.

Keywords: Low back pain, Functional disability, Training, Teacher

Introduction

One of the non-transmissible diseases which have produced main problems for today's society is Musculoskeletal Disorders (MSDs) caused by work.

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Musculoskeletal disorders are among the common causes of occupational injury and disability in industrialized and developing countries (David, 2005). Skeletal disorders are defined as conditions in which muscles, tendons, and nerves are damaged. Their symptoms begin to fatigue, pain, discomfort, and numbness and lead to a disease in which limb movement is limited, or muscle strength is reduced (Asghari, Omidiyani, & Farvaresh, 2012; Centers for Disease Control and Prevention, 2013). Musculoskeletal disorders account for nearly half of all the diseases caused by work and are the main cause of decrease in

working hours and increase in cost and work-related injuries (Kemmlert, 1995). One of the main reasons for absenteeism is musculoskeletal injuries so that according to the reports, about 44% of the work-related compensation costs are related to musculoskeletal disorders (Palmer et al., 2012). In UK, in 2013-2014, from among 1241,000 MSDs cases, 526,000 cases were associated with occupational diseases, which resulted in 15.9 days sick leave for each person (Health and Safety Executive, 2014). In many studies, factors such as intense physical activity, high physical activity, repetitive movements, inappropriate physical condition or performance, high speed at work, lack of rest between work stages, work shift, individual factors (age, gender, height), high BMI (Body Mass Index), inadequate work experience and education are known as the prevalent MSDs factors (Volkers, Westert, & Schellevis, 2007). The need to improve the work situation has been proven in a large number of studies, indicating a direct relationship between undesirable postures and functional abnormalities or pain in various parts of the musculoskeletal system (AARÅs & Strandén, 1988; Zakeriyan et al., 2012; Dehghan, Choobineh, & Hasanzadeh, 2013).

Studies show that back pain is one of the most commonly diagnosed diseases of the skeletal system so that 58-84% of the people in the community experience it once in their lifetimes, and in 50% of the adults, low back pain occurs in career ages (Rubin, 2007; Nuri et al., 2011). Low back pain is the first cause of disability in people under 45 years old, the second cause of referring to the doctor, and the third cause of surgeries (Nuri et al., 2011). According to the reports, low back pain is more common in young women (Andersen, Wedderkopp, Leboeuf-Yde, 2006). In developed countries, the overall cost spent on back pain is annually about 1.7% of all national gross products (Nuri et al., 2011). In people under 45 years old, low back pain is the most important limiting factor for personal and social activities so that 23 days of a year were wasted for each person, and it causes people to lose their working days (Salvati, 2002). Also, low back pain is the main cause of disability and absenteeism (Maetzel & Li, 2002).

In Iran, limited epidemiological studies have been conducted on the prevalence rate of low back pain. In one of the comprehensive studies conducted in 2012 in Iran on the prevalence rate

of low back pain and its underlying conditions, a large sample of 25307 people with the age ranges from 65-20 years were included. In this study, the prevalence rate of low back pain in the studied population was reported as 29.3% (Tavafian, Gregory, & Montazeri, 2008). In another study conducted on musculoskeletal problems in rural areas of Iran, the prevalence rate of low back pain was reported as 23.4% (Davatchi et al., 2009).

Teachers are among the working groups who are at risk for musculoskeletal disorders due to the type of their occupations, and most of them may have pain due to these disorders. Most teachers' tasks are in standing conditions with "head down" mode or in sitting conditions like repeated reading, correcting assignments, and writing on the blackboard, which may affect their physical and mental health (Erick & Smith, 2011). Several studies have reported the prevalence rate of MSDs among the teachers in different country from 39 to 95% (Erick & Smith, 2011; Korkmaz, Cavlak, & Telci, 2011; Chong & Chan, 2010; Fjellman-Wiklund & Sundelin, 1998).

In people with chronic low back pain, changes in deep muscle stabilization activity due to pain or injury lead to disrupted posture control and reduced body control and damage. Hence, corrective movements and appropriate exercises are one of the common and good treatments for reducing back pain. The main goal of these exercises is to gain the strength, tolerance, and flexibility of the spine in order to improve injuries (Kofotolis & Kellis, 2006). Ergonomic training is the oldest and, most commonly used approach to prevent back pain (Zakeriyan, 2007). After ergonomic training, exercise therapy is one of the most effective treatments for back pain that patients can do alone, with other treatments (Airaksinen et al., 2006; Hayden, Van Tulder, & Tomlinson, 2005). Although the effect of training on the reduction of pain due to skeletal disorders has been proven (Moon et al., 2013; Rhee, Kim, & Sung, 2012; Babaei, 2013; Kamali Sarvestani, Derakhshan Rad, & Hamooleh, 2012), not all training methods are equally effective or cost effective. Choosing an appropriate training method is one of the most important steps in the course of designing a training program because an effective learning is most of all resulted from a good training method. Due to the compaction in

teachers' work and the existence of an electronic educational structure in the country education system and budget limitations, choosing health education methods on common health problems should be cost effective and based on effective evidence. Therefore, regarding the prevalence rate of low back pain among teachers and the effectiveness of training in reducing pain, identifying more effective training methods is necessary. Therefore, this study was conducted with the aim of designing, implementing, evaluating, and comparing the effectiveness of two direct and indirect training methods in reducing the teachers' pain and functional disability caused by musculoskeletal disorders in Savojbolagh city.

Materials and Methods

This study was designed as an experimental study. In this study, among the 235 volunteer teachers with low back pain, 175 cases having the criteria for entering the study were included. The inclusion criteria were as follows: having at least two years of work experience, confirmation of musculoskeletal pain after examination by a chiropractic specialist, chronic pain (history of pain greater than 12 weeks), and a maximum score of 7. Also, exclusion criteria were as follows: having a history of specific systemic disease, surgery, spinal cord injury, and structural disorder in the spine and organs. The subjects were randomly assigned into three groups using Random Allocation software (RAS) version 9. The first group with 70 students was trained during a training session (3 hours) by lecture and practical presentation. The second group with 70 students was trained by a CD in accordance with what was taught to the lecture group; therefore, the content of the training was the same in two experimental groups. The control group with 35 students did not receive any training. The instructor in both experimental groups (face-to-face training and training through a CD-ROM) was a chiropractic doctor who had examined volunteers.

To measure the amount of back pain in patients (during the past one to two weeks), it was made use of the VAS measurement scale which is a 10 cm bar; one end of which is zero (that is painless), and the other end is 10 (the most possible severe pain). The more the pain gets closer to 10, the most pain will be, and the more the pain gets closer to zero, the less pain will be. VAS is the

most reliable pain grading system for comparing different periods, which has been widely used in research (Price et al., 1983; Cairns, Foster, & Wright, 2006). Its reliability and validity is excellent, and its internal reliability is acceptable ($ICC^1 = 0.9$) (Boonstra et al., 2008; Rezvani et al., 2012). The Oswestry disability (ODI²) questionnaire was used to measure disability levels (during the past one to two weeks) (Nuri et al., 2011; Kamali Sarvestani, Derakhshan Rad, & Hamooleh, 2012). This questionnaire shows the functional disability of people with low back pain in percentage terms. The lower the disability indicator, the more a person is healthy and can perform daily activities with less pain while more points are as an indicator of severe acute disability due to severe pain so that one can hardly do the job.

Mousavi and his colleagues provided the Persian version of the questionnaire and reported its reliability and validity in the Iranian community ($ICC = 0.91, \alpha = 0.75$). This questionnaire provides good information about the various aspects of a patient's disability in performing the therapist vities for therapist (Mousavi et al., 2006).

Findings

Demographic characteristics of the participants in this study are presented in Table 1, separated according to the experimental and control groups. As shown in Table 1, although the majority of participants were female, there was no significant difference between women and men in the three groups. There was also no significant difference in mean age between the groups; however, the highest and lowest work experience was observed in indirect training and control groups, respectively which were statistically significant. Differences were also significant in terms of average working hours per week; the highest working hours were reported to be in an indirect training group, followed by direct training group, and finally, the lowest working hours were reported the control group control group. It should be noted that the hours worked by indirect training group were significantly higher than the control group; however, there was no significant difference in working hours between the direct training.

1. Intraclass correlation coefficient.
 2. Oswestry Disability Index.
- Group and none of the other two groups.

Table 1. Demographic information.

Variables	Control Group	Direct Training Group	Indirect Training Group	Results
Age	39.8 ± 5.4	40.5 ± 6.9	40.8 ± 6.1	$P = .561$ $F = .579$
Work Experience	16.5 ± 7.4	16.9 ± 7.3	19.0 ± 7.7	$P = .025$ $F = 3.74$
Working Hours Per Week	27.7 ± 7.28	25.8 ± 5.25	29.3 ± 8.59	$P = .001$ $F = 8.53$

According to the Table 2, there was no significant difference in terms of mean of pain before the intervention between the control group and direct and indirect training groups. However, the mean score of pain after the intervention was significantly different between the control group and direct and indirect training groups. Using Tukey test to compare the groups in pairwise

mode, it was shown that there is a significant difference between the three groups. Using the Dunnett test, it was found that there is a significant difference in the amount of pain between the direct and indirect training groups so that the highest pain intensity was observed in the control group, and the least was observed in an indirect training group.

Table 2. The degree of pain and functional disability in the studied groups before and after the intervention.

Groups	Number (n)	Mean of Pain ± SD		Results	Functional Disability Mean ± SD		Results
		Before the Intervention	After the Intervention		Before the Intervention	After the Intervention	
Control	35	5.11 ± 1.43	5.06 ± 1.39	$t = 1.435$ $p = .160$	30.34 ± 14.0	30.06 ± 13.6	$t = 1.435$ $p = .32$
Direct Training	70	5.13 ± 1.54	3.79 ± 1.76	$t = 9.438$ $p = .001$	29.60 ± 10.97	20.74 ± 10.16	$t = 6.96$ $p = .001$
Indirect Training	70	5.11 ± 1.57	2.63 ± 1.56	$t = 15.546$ $p = .001$	33.06 ± 13.04	19.43 ± 12.47	$t = 10.846$ $p = .001$

The mean score of functional disability before the intervention between the control group and direct and indirect training groups was not statistically significant. However, the mean score of functional disability after the intervention was significantly different among the groups. Using the Tukey test, it was found that there is no significant difference between the direct and indirect training groups after the intervention in terms of functional disability, but both groups had a significant difference with the control group. Using Dunnett test, it was also found that there is no significant difference between the two direct and indirect training groups ($p = .0746$); in other words, the most severe disability was related to the control group. The degree of disability in direct and indirect training groups was close to each other, but in both of these groups, the disability was less than the control group.

As shown in Table 3, considering the role of probable confounding variables such as the severity of pain and disability before the intervention, age, sex, work experience, working hours, education level, marital status, and the

severity of pain and disability after the intervention, it can be stated that there is a significant relationship between pain and functional disability before and after the intervention; however, this relationship is not significant in other variables (age, sex, work history, hours of work, education level and marital status).

Table 3. Regression analysis of research variables (dependent variable of pain and disability after intervention).

Dependent Variables	Pain p	Functional Disability p
Constant Number	.135	.751
pain before intervention	.001	.001
Age	.72	.679
Sex	.134	.149
Work Experience	.652	.609
Working Hours	.110	.10
Education	.352	.173
Marital Status	.927	.266
Study Groups Intervention	.001	.001

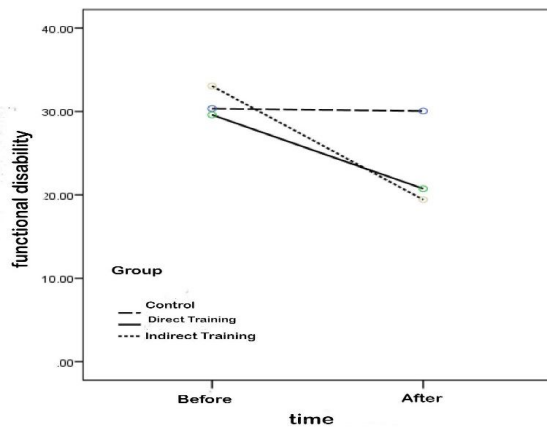


Figure 1. shows the extent to which functional disability changes.

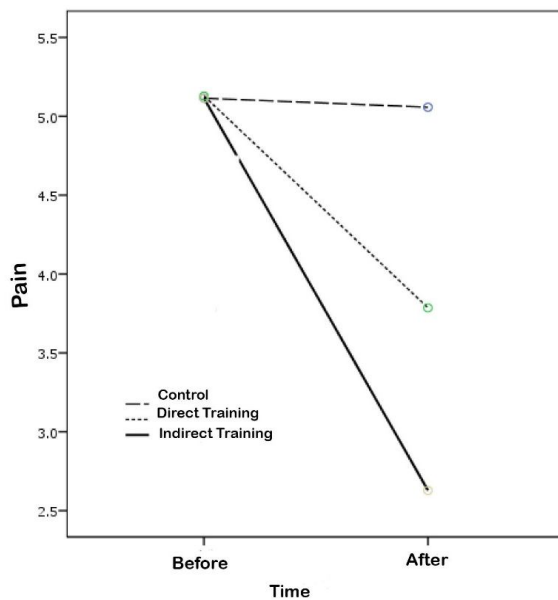


Figure. 2 shows the pain variations in different groups.

Discussion

Undoubtedly, teachers' low back pain reduces their functional ability and has negative impact on their professional performance, and consequently, on the process of student's learning. This study showed that proper training had a positive effect on low back pain so that even holding a training class reduced the back pain and functional disability among teachers by 26 and 30%, respectively. On the other hand, the distribution of a CD was able to further reduce the teachers' pain (42%) and functional disability (50%), especially in those who had more working hours. Given that only one good training session was able to significantly reduce teacher's pain and functional disability, and a worthwhile film was able to reduce 49% of the

teachers' pain and functional disability, therefore, the importance and urgency of providing ergonomic training that does not impose much cost of the educational system is felt for teachers with back pain, and even those with no back pain. The exercises used in this study as a package of patients' treatment were very simple exercises that did not require special equipment and can be done in any place and conditions. It is even possible that after the end of the treatment course, the patients undergo these exercises when they have pain. Various studies have confirmed the effectiveness of educational interventions and ergonomics in reducing pain and functional disabilities caused by occupational skeleto-musculoskeletal disorders (Kamali Sarvestani, Derakhshan Rad, & Hamooleh, 2012; Owen, Keene, & Olson, 2002; Robertson et al., 2008; Kee & Seo, 2007). Another study showed that, 5 years after applying ergonomic program, not only the amount of back and shoulder injuries, but also lost working days and limited working days significantly reduced (Owen, Keene, & Olson, 2002); of course, the training methods and pain reduction were different in different studies. For example, in a study in Iran using the educational pamphlets, the mean of pain severity in the staff based on VAS scores changed from 4.67 in the pre-intervention period to 2.62 in the post-intervention period; also, the average disability score changed from 23% in pre-intervening period to 17% in post-intervention period, both of which were significant (Kamali Sarvestani, Derakhshan Rad, & Hamooleh, 2012). In another study, the control group received only ergonomic training, and the experimental group received a combination of therapeutic exercises and ergonomic training through virtual space. Low back pain in the experimental group with lumbar abnormality, which was trained in virtual space compared to the control group, changed from 42.7 to 8% (Babaei et al., 2013).

In another study by Rhee and colleagues in 2012, the results showed that in two experimental groups, the amount of pain and the degree of disability decreased significantly. Also, the results of Rhee studies on the effect of confounding factors (age, gender, and weight) are consistent with the results of this study (Rhee, Kim, & Sung, 2012).

Some existing studies suggest a positive impact of electronic ergonomics training on improving individuals' awareness, attitude, and practice (Jacob & Taveira, 2011) and also on reducing

pain (Babaei et al., 2013; Jamshidi, Abbaszadeh, & Najafi-Kalyani, 2011). In another study, the control group received routine oral education by nurses in the angiographies section, and the experimental group was presented an educational film containing the before, during, and after angiography necessary measures. After angiography, the patients' degree of fatigue and pain were measured using the VAS. The results of this study showed that training through the film caused a significant reduction in patients' low back pain after the angiography (Jamshidi, Abbaszadeh, & Najafi-Kalyani, 2011), which is in line with the results obtained in our studies. It seems that greater impact of the use of film method compared to direct method is mainly due to the ability to repeat the trainings in different situations while learning through direct methods can quickly be forgotten if not be practiced. The repeated use of educational content minimizes the possibility of forgetting presented in direct training over time. In addition, the nature of this method is probably more attractive to attract attention. It can also be said that training through compact disc provides opportunities and benefits with more flexibility for learners in the learning process which is not limited in time and space (Padalino & Peres, 2007). On the other hand, indirect method may be many times cheaper than face-to-face training. Overall, both methods have been effective in reducing pain, which can partly reflect the good quality of training design, especially in transferring skills.

Conclusion

Regarding the prevalence rate of low back pain and functional disability among the professionals such as teachers and the existence of scientific evidence about the effectiveness of training in reducing these problems, it is possible to place pain relief training programs as part of teachers' in-service training or technical training in order to promote their health. On the other hand, due to the compactness of the teachers' curriculum and the difficulty in coordinating common free time among teachers to attend to direct training classes as well as the cost of holding training classes, the use of effective indirect methods should be given more attention by education officials. Therapeutic exercises in this form can be recommended as an independent treatment method for treatment of patients with low back pain. In addition to

accelerating the pain reduction, doing this form of exercise improves mental condition and ultimately reduces the rate of disability caused by the back pain. It seems that ergonomic training for all teachers should be part of their educational and health services. Due to lower costs of using educational videos, it is easy to help teachers improve their health through which. Due to the existence of in-service programs as well as electronic educational structures, it is recommended that all health-related educational materials which have scientific quality and credibility, be electronically available to all teachers throughout the country.

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