The Effect of 12 Weeks of Using Stability Ball in Working Environment on the Intensity of Pain and Disability in the People with Chronic Low Back Pain

Danial Golbidi¹, Mojtaba Babaei Khorzoghi², Jafar Ketabchi³*, Mahnaz Manshouri⁴

¹Radiologist, Department of Radiology, Faculty of Medicine, University of Medical Science, Isfahan, Iran.
²Instructor of Physical Education, Isfahan University of Technology, Isfahan, 84156-83111, Iran. And PHD Student of Physical Education and Sport Science, major of Pathology and Corrective Exercises, Shahid Bahonar University of Kerman, Kerman, Iran.
³M.sc of Sport Injuries and Corrective Exercises, University of Isfahan, Isfahan, Iran.
⁴Physical Education Center, Isfahan University of Technology, Isfahan, 84156-83111, Iran.

Abstract

Introduction: low back pain is common among the employees who sit at the table for long hours. Comparing to sitting on office chair, sitting on stability balls causes activation of the core muscles of the body. Increasing the activity of core muscles in the central part of the body causes the increase of stability in Lumbo-pelvic-Hip complex which can be efficient in improving the pain, signs and symptoms of the patients with chronic low back pain. The objective of the present study was the transitional use of 12 weeks of stability ball instead of office chairs on pain indexes and disability in the patients with chronic low back pain. Material and methods: 28 men suffering from chronic low back pain (mean± standard deviation of age 42±5, BMI, 24±2 ) were selected to take part in the study through convenient method. The participants of the present study used stability ball for 12 weeks instead of office chair during some hours of their working (maximum two hours) at the office. The pain intensity and disability of the subjects were measured through applying QUEBEC and OSWERTRY questionnaires. Dependent sample t-test was used at 0.05 levels to analyze the data. Findings: a significant difference was observed in the relationship between pain intensity and disability in the participant people (P<0.05). The mean of pain intensity and disability in the people participating in the pretest were 26.4±5 and 24.2±5.4 respectively. After administering therapeutic protocol, the mean of pain intensity and disability decreased to 18.6±4.7 and 21.2±4.7 which showed an improvement of 29% and 12% in the pain intensity and disability in these patients. Conclusion: sitting on stability ball leads to more activation of core muscles of the body especially deep stabilizers in this part. Activating deep stabilizers in the core part leads to the improvement of the condition of patients suffering from chronic low back pain. According to the results of the current study, sitting on stability ball instead of office chair in working hours can cause more activation of core muscles. Therefore it is recommended to use stability balls instead of office chairs. although just the improvement of working environment cannot lead to the treatment and improvement, so making such changes along with other therapy modalities can cause more effectiveness on the condition of the patients suffering from chronic low back pain.

Keywords: Chronic low back pain, Stability ball, Quebec questionnaire, Core stability, Oswertry questionnaire.

Introduction

Low back pain is the commonest disorder observed in rehabilitation clinics [1]. About 80% of the world populations experience a kind of low back pain in their lives [2]. Chronic low back pain is a type of backache pain which is with the individual for more than three months and it leads to the change of the individual's life style and decrease of his/her physical activities [3]. Therapy charges for the low back pain is unbearable taking its high prevalence in a way that in American society it is estimated that about...
25 billion dollars are charged for the low back pain annually [4].

Low back pain causes creating compensatory strategies in the people suffering from it. Delayed starting of multifidus and transverse abdominal muscles has been reported in the people with chronic low back pain [5].

In the people with no low back pain, activation of multifidus and transverse abdominal muscles occurs 30 milliseconds before upper limbs movements and 120 milliseconds before lower limbs movements [6]. In the people with chronic low back pain, even in the absence of backache, multifidus muscles atrophy was observed that it is the sign of change in movement pattern and activation of the muscles in the core part of the body [7]. Changing the activation pattern in core muscles and decreasing the stability of deep muscles in this area is one of the most fundamental problems related to chronic low back pain [5].

Today stability of core part of the body has changed into one of the most interested fields for the therapists and athletic trainers. Health programs like Pilates, tai chi, yoga, follow the principles of reinforcing central stability. Core stability enjoys very extensive advantages including development of athletic administration, avoiding damages and decreasing low back pain [8].

The core part of the body is considered as a muscular box wherein abdominal muscles are located in the front, spine and gluteal muscles are located in the back, diaphragm is located on the ceiling and pelvic floor muscles and pelvic belt muscles are located in floor (figure 1). There are 29 pairs of these muscles which help spine, pelvis and global chain stability of functional movements. Without these muscles, the spine becomes instable mechanically and will damage under very few loads. Suitable stability and activation of the muscles of this system lead to the health of all neuro-musculoskeletal structures [8].

![Figure 1](image-url)
the stabilizing role of muscles and its importance changes [9]. So on-time activating of the muscles in each angel and with each movement is of high importance.

Stability balls have found many fans as one of the most popular athletic and rehabilitation equipment today. The advantage of stability balls is beyond the area of rehabilitation, these balls can be used in preparing the athletes and preventing injuries too [13]. These balls are recognized in other names like Swiss balls and physioball too. One of the most basic applied uses of this tool has been to rehabilitate low back pain. It has pointed out that using stability ball causes the increase of muscles activity in trunk area [10]. It has been mentioned that these balls cause the increase of muscles activation of core part and on-time stability, strength and activation [10].

Cholewicki, et.al revealed that sitting on stability balls (unstable plane) compared to sitting on office chair leads to the increase of muscles activation in the core area and permanent increase of center of pressure in anterior-posterior and internal-external directions [11]. Diane et.al reported the increase of EMG activity in right Multifidus muscle in using stability ball comparing to office chair [12]. The recent research has reported the increase of abdominal muscles activation in using stability balls [13]. Marshall et.al stated that touching the body with an unstable object such as stability ball and doing exercise on this ball lead to the increase of abdominal muscles activation [13].

Paul et.al have reported the increase of activation of rectus abdominal, transvers abdominal, internal abdominal and internal abdominal oblique muscles via using stability ball compared to usual benches through comparing muscular activation level of lumbo-pelvic complex during doing some exercises.

They pointed out, too, that performing movement on Swiss ball directly affects muscular synergist relationship between rectus abdominal, transvers abdominal, erector spine, internal and external muscles obliques [14]. In another study by Paul et.al reported the increase of rectus abdominal muscle activation followed by lumbo-pelvic muscles after using stability ball [15]. Chung et al reported the increase of multifidus muscles transverse cross section activation in the patients with low back pain in using stability ball through investigating the effect of back stability exercises via Swiss ball. They point out that using stability ball in rehabilitating patients suffering from low back pain leads to the patients’ faster recovery and decrease of their pain during treatment. [16].

In spite of the studies in the field of the effectiveness of using stability balls in rehabilitation and increasing activating core muscles and the improvement of musculoskeletal disorders such as low back pain, permanent sue of stability ball causes muscles fatigue and feeling unpleasant [17]. Therefore it has been advised not to use stability balls permanently instead of office chair. Its reason might be continual changes of center of pressure which causes permanent activation of the muscles of the core and causes fatigue and sadness in the individual.

It has been acknowledged that using stability ball causes the increase of activation of the muscles of the core and the improvement of contraction timing, stability, stamina and strength of the muscles in this part, especially deep stabilizers. In people suffering from low back pain, the back muscles change their movement pattern and show delayed contraction and also decreasing stability, stamina and strength. Perhaps one of its most basic reasons is the permanent use of a specific position such as sitting on office chairs. So the objective of the present study was to assess the replacement of stability balls with office chairs in the patients suffering from chronic low back pain.

Material and Methods

28 male employees were selected through convenient method. Inclusion criteria included not having score more than fifty in QUEBEC questionnaire and more than forty in OSWESTRY questionnaire, low back pain more than three months, lack of receiving other therapeutic modality in the study, lack of participation in exercise and lack of referential pain to the lower limbs. The age mean ± standard deviation of the participants were 39.5±2.4 years, weight mean± standard deviation of the participants.
were 71.5±7.2 kilograms, height mean± standard deviation of the participants were 1.71±0.1 meters and their standard BMI mean± standard deviation were 24.2±1.9.

Stability balls are available in different sizes and colors (figure 2). These balls were given appropriate for the table height and participants’ height. Generally the balls larger than 80 inches were used for the most samples. At first, standard method of sitting on stability balls was trained with the subjects. Common problems while sitting on the stability ball were great lordosis, making the neck round (decreasing lordosis), too front bending (high trunk flexion) and too forward bending of the head (forward head posture). All the above mentioned problems in the first session of using ball were trained with the subjects and the manner of standard sitting on the ball was taught to them. In the first days, the subjects sat from five to ten minutes on the ball in their working environment and gradually the time was increased so that in the twelfth week each subject sat on stabilization ball for the average of two hours from their official time instead of office chair. The subjects were asked not to use stability ball permanently, since it was pointed out in the literature that permanent using of stability balls instead of office chairs causes fatigue and discomfort.

Figure 2: Different types of stability balls in different sizes

QUEBEC standard and OSWESTRY questionnaires were applied in order to assess the degree of pain intensity and disability. QUEBEC questionnaire included 25 five-alternative questions and pain intensity in each question was rated from zero to four and the whole questionnaire was rated from zero to one hundred. Scores zero to 25 indicate little pain, 26 to 50 disease with medium pain, 51 to 75, high pain and above 75 implies acute and disabling pain [18].

Oswestry questionnaire included ten six-alternative parts which investigates the manner of people’s performance in daily activities. Each part rates the degree of disability in performance respectively from zero (desirable performance without feeling painful) to five (disability in performing activity due to intense pain). OSWESTRY disability index equals the score totals of 10 parts multiplied by 2 and owns the value of zero to 100. Disability index of zero shows that the individual is healthy and able to do daily activities without pain. Zero to 20 is low ability, 21 to 40 is medium disability (moderate), 41 to 60 is high disability, 61 to 80 is intense disability and higher score means totally acute disability wherein the individual cannot do anything [19].

The participants of the study used stability ball instead of office chair during 12 weeks every day for the maximum of two hours. The subjects at first used stability ball from 5 to 10 minutes and gradually increased the time of using it. Furthermore, they were asked not to use stability ball permanently due to their tiring effect. The size of stability ball was selected in a way that the individual doesn’t have to bend forward or create other unsuitable postures. Finally after twelve weeks again QUEBEC and OSWERTRY questionnaires were applied to compare the state of the people’s pain intensity and disability.
Findings
After twelve weeks, in order to analyze the people’s pain and disability state, dependent sample t-test was used at 0.05 significance level via SPSS16 software.

Pain Intensity
A significant difference was observed in pain intensity after twelve weeks of using stability ball in the patients with chronic low back pain (P<0.05). The mean of pretest of pain intensity was 26.4±5.0 which lowered to 18.6±4.7 after twelve weeks (graph 1). The independent sample t-test showed a significant difference in the pretest of pain intensity comparing to the posttest at significance level of 0.05.

Disability
A significant difference was observed in the degree of disability after twelve weeks of using stability ball in the patients with chronic low back pain (p<0.05). The mean of pretest of disability was 24.2±5.4 which lowered to 21.2±4.7 after twelve weeks (graph 1). The independent sample t-test showed a significant difference in the pretest comparing to the posttest at significance level of 0.05. Table 1 shows the comparison of the variable of pain intensity and disability before and after twelve weeks of using stability ball.

Discussion
The objective of the present study was to investigate the effectiveness of a twelve-week period of using stability ball instead of office chair on pain intensity and the degree of disability of the patients with chronic low back pain. After twelve weeks of using stability ball, the mean of pain intensity and disability decreased in people that were significant in both indexes.

Control and stability of the spine is very important in preventing and rehabilitating the patients suffering from low back pain. Stability of spine is created through deep local muscles such as multifidus, transvers abdominal muscles and global muscles such
as obliquies and rectus abdominal muscles. In the patients suffering from low back pain the posture of controlling trunk muscles is disturbed and the activity of deep muscles of this area is decreased [9]. These muscles are followed by the delay in activity and decrease of tone and atrophy [9]. Hides et.al consider the decrease of cross-section of multifidus muscles in the patients with chronic low back pain because of reflexive inhibition and pain [20]. Therefore using therapeutic interventions which can affect the activity of these muscles can be of high importance.

Rafael et.al reported the increase of activating rectus abdominal, internal and external oblique's and Latissimus-dorsi muscles while using stability balls comparing to other stable and fixed levels [21]. Many studies addressed comparing the activation of core muscles in using stability balls to stable environment and fixed levels. Most of these studies have stated that the activity level of core and especially abdominal muscles increases through using stability ball [22, 23].

Diane et.al addressed the comparison of activating core muscles in sitting on stability ball and sitting on the office chair [10]. They concluded that using stability ball causes the increase of erector spine muscles activity, decrease of pelvis tilt and the increase of boredom in the long-run use of stability ball. Therefore they recommended not to use stability ball permanently to get to better results. The co-contraction of trunk core muscles and increase of the activity of these muscles and the improvement of the state of the patients with low back pain in using stability balls instead of office chair have been mentioned [11]. Arokoski et.al stated the increase of lumbar-thoracic spinal erectors activity using instable instruments such as stability ball comparing to fixed and stable instruments [24]. The major objective of core fixation exercises includes reestablishing control of deep muscles and activating through desirable timing of core muscles [25] that can be achieved through using stability balls.

The improvement of the condition of chronic musculoskeletal disorders such as low back pain require therapeutic interventions such as therapeutic practice, medication, changing the life style and method.

Tiny cumulative pressures on the body equal acute heavy pressures. Changing life method and style is one of the basic methods to cope with these micro-traumas. Using stability ball in the working environment can both cause changing the people’s sitting manner and maintaining their correct sitting posture and be a kind of practice in the working environment without disturbing the people’s daily works and affairs through more activation of the core muscles without being noticed on the part of the individual. Permanent use of stability ball as the office chair due to permanent change of pressure center causes boredom in disturbing correct body direction.

So it is recommended that when the individual feels tired while using stability ball he/she should postpone using the ball to remove the boredom. In the present study the employees with chronic low back pain used stability balls during twelve weeks instead of office chairs in some hours of their working which decreased their pain intensity and disability after finishing the period comparing to the period before using it.

**Conclusion**

Taking the mean of pain intensity and disability in the pretest and posttest, using stability ball after twelve weeks is effective in decreasing the pain and disability of the people with chronic low back pain. Perhaps more activation of core muscles, especially deep muscles of this part is the most basic reason in improving the patients’ condition. Although this improvement was significant, but in the researcher’s idea this decrease of pain and disability in these people is not sufficient to improve their chronic condition and treat them and other therapeutic modalities are necessary to improve the patients’ condition.

**Suggestions**

Due to the absence of control group in the present study, generalizing the results to a larger society is difficult. So it is suggested to apply a control group in the future studies. Moreover it is recommended to regulate the size and the degree of air pressure inside the ball appropriate for each person in order to get to more meticulous results.
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References
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