McGill Exercises versus Conventional Exercises in Chronic Low Back Pain

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Abstract: Background: McGill exercises are designed to impose minimal spinal loading while sufficiently challenging the abdominal and spinal muscles. The purpose of this study was to compare between the effects of McGill exercises and conventional exercises on physical function in patients with nonspecific chronic low back pain (LBP). **Setting:** A physical therapy outpatient clinic. **Participants:** Sixty participants with nonspecific chronic LBP completed the program. Pain duration was more than 12 weeks. **Interventions:** The first group (n=30, mean age= 44.7±15.1 years) received Infra-red and conventional exercises (stretching and strengthening exercises). The second group (n=30, mean age=47.2±13.8 years) received Infra-red and McGill exercises. **Materials:** Performance based measures (the fifty-foot preferred speed walk, fifty-foot fast walk, and distance walked in five minutes) were used to measure physical function before and after 6 weeks of treatment. **Results:** The second group showed statistically significant increase in physical function as measured by the fifty-foot preferred speed walk ($F_{1,57}$=6.7, P=.01), fifty-foot fast speed walk ($F_{1,57}$=7.4, P=0.001), and distance walked in five minutes ($F_{1,57}$=10.4, P=0.001). **Conclusion:** McGill exercises increased physical function of patients with nonspecific chronic LBP. In this study, McGill exercises were of value for patients with nonspecific chronic LBP.
[Tarek Ammar. **McGill Exercises versus Conventional Exercises in Chronic Low Back Pain.** Life Sci J 2012; 9(2):393-397]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 60

Key Words: Low back pain, McGill, Exercises, Function

1. Introduction

Low back pain (LBP) is one of the most common costly health problems due to the considerable impact on daily functioning, sickness absence, and work disability.[1,2] The prevalence of LBP and the number of patients seeking care with physical therapy has increased over the last two decades.[3] There are many approaches to treat LBP such as medications, surgery, massage, traction, ultrasound, laser, ergonomics, heat, stretching and strengthening exercises.[4] However, there is no agreement among physicians and physical therapists about the best interventions for LBP.[5]

Various programs of stabilizing exercises have been used in treatment of patients with LBP.[6,7-8] McGill proposed safe stabilizing exercises to enhance spinal stability without imposing high loads on the spine in patients with LBP.[9] These exercises would achieve appropriate levels of activation of all back and abdominal muscles (rectus abdominis, quadratus lumborum, obliques, transversus abdominis, multifidus, and erector spinae), with minimal spinal loading to ensure spinal stability in patients with LBP.[9]

Some commonly used conventional exercises provide substantial compressive loads on the spine that would serve only to ensure the patient would remain a patient.[10] For example, extending the trunk and arms from a prone position resulted in 6000 Newtons of spinal compression thus exceeding the National Institute of Occupational Safety and Health (NIOSH) guidelines.[10] Researchers of the NIOSH conducted a field study recording injury rates with various levels of calculated spine compression (NIOSH, 1981).[11] They set the action limit for compressive loading of the lumbar spine at 3400 Newtons. Repetitive loading above this limit is not recommended and activities are safe as long as the spinal loading is below that number.[9] Therefore, patients with LBP should receive exercises that do not impose spinal loading in excess of 3400 Newtons such as the stabilizing exercises of McGill. There has been little research about using McGill exercises in different patient populations. Patients with LBP shows decreased physical function.[12] Therefore, enhancing physical function is of a high priority in treating patients with LBP. No randomized controlled trial tested the assertion that McGill stabilizing exercises is beneficial in a sample of patients with nonspecific chronic LBP using physical performance tests as outcomes. The purpose of this study was to compare between the effect of McGill exercises and conventional exercises in increasing the physical function of patients with nonspecific LBP.

2. Material and Methods

Design

Participants were randomly assigned to one of two treatment groups: (1) a group that received Infra-red and the conventional exercises or (2) a group that received Infra-red and McGill exercises. The research physical therapist who performed the outcome assessments of participants and data analyses was unaware of group allocation. However, the clinical physical therapist who administered the exercises was aware of group allocation. Participants were not

aware of the theoretical bases of each of the exercise regimens because the study's objective was described to them in the following way: "to compare between two physical therapy programs for the trunk muscles, which may have a role in increasing physical function of patients with LBP.

Participants

Sixty seven participants with nonspecific LBP were recruited from a physical therapy clinic. Inclusion criteria included males or females of any race with a history of nonspecific LBP between T12 and the gluteal fold for more than 12 weeks. Exclusion criteria included a history of previous lumbar surgery, spinal stenosis, spondylolisthesis, neurological dysfunction, systemic disease, injection therapy, carcinoma, or pregnancy. All participants received their assigned interventions two times a week for the six week period of the study. They signed a consent form prior to participation in the study.

Materials

Three performance-based measures (fifty-foot preferred speed walk, fifty-foot fast speed walk, and distance walked in five minutes) were used to measure physical function in patients with LBP. For the fifty-foot preferred speed walk, the patient walks forward at his/her preferred walking speed for 25 feet and turns around and returns to the starting position.[12-13] For the fifty-foot fast speed walk, **t**he patient walks as fast as possible forward for 25 feet and turns around and returns to the starting position. [12-13] For the distance walked in five minutes**,** the therapist measures the farthest distance the patient can walk within five minutes.[13-15] They have been reported as valid and reliable measuring tools in LBP.[12-13]

Interventions

Prior to participating in the study, each participant was randomly assigned to either a control group (Group 1) or a treatment group (Group 2), using a table of random numbers. A physical therapist tested the participants at both the initial and final sessions. Another therapist performed all interventions. Participants of both groups received infra-red for 15 minutes. The conventional exercises included stretching and strengthening exercises for the trunk and the lower limbs. Participants received a series of progressive exercises building up to a maximum of 10-12 exercises by the final visit based on their individual needs. Participants carried out one set of 10 repetitions for each exercise, with a 30-second to one-minute rest between each set during each exercise session. For a home exercises, participants also performed four to six exercises of the conventional exercises on the basis of individual needs. Participants performed two sets of 10 repetitions for each exercise, with a 30-second to one-minute rest between each set, twice per day on the days when they did not come to the clinic.

Participants in the second group received McGill exercises. Each patient was trained to find his/her neutral spinal posture prior to initiating the stabilizing exercises. The McGill program begins with a motion exercise (cat-camel motion exercise). It consists of six-to-eight cycles of spinal flexion and extension in a quadruped position. This is followed by the curl-up exercises, in which the patient flexes one knee while keeping the other straight to minimize loss of the neutral posture. Then, the patient gently raises just the head and shoulders a short distance off the floor. This exercise can be followed by the side-support exercise. The patient is positioned as follows: lying on the side supported on his/her elbow and hip, knees bent to 90º, free hand placed on the opposite shoulder. The patient then raises his/her trunk until the body is supported on the elbow and the knee. If the patient was not able to perform the side support exercise, the patient would assume the side lying position and initiate an isometric contraction of the quadrates lumborum by trying to lift both lower limbs up toward the ceiling. Upon successful performance of the side support exercise, the birddog exercise (opposite arm and leg extension in the quadruped position) was carried out. In the quadruped position, the patient can also perform single leg lifting and/or single arm lifting. However, they performed one set of 10 repetitions for each McGill exercise, with a 30-second to one-minute rest between each set during each exercise session.

For a home program, participants performed four to six McGill exercises. They performed two sets of 10 repetitions for each exercise, with a 30-second to one-minute rest between each set, twice per day on the on the days when they did not come to the clinic. In both groups, the therapist asked the participants to use weekly self-report exercise logs to monitor the home program.

Data Analysis

Separate univariate analyses of covariance with the pretest scores as the covariates, were performed to determine whether there is a difference between the two groups on the posttest scores of physical function. A Bonferroni approach was used to maintain the alpha level at $P < 0.05$.

3. Results

Sixty seven participants with nonspecific chronic LBP participated in this study. However, in Group 1, three participants missed more than two physical therapy sessions due to scheduling and transportation difficulties In Group 2, four participants missed more than two physical therapy sessions due to scheduling conflicts. Data of 60

participants who completed the study were statistically analyzed.

Group 1 comprised 30 participants (19 females and 11 males) average age 44.7±15.1years, height 67.2 ±11.2 inches, and weight 159.2 ± 23.2 pounds. Group 2 comprised 30 participants (17 females and 13 males), average age 47.2 ±13.8 years, height 70.1 ± 9.4 inches, and weight 165.1 ±22.3 pounds. No adverse events were observed or reported by any participant in either intervention group. The ANCOVA revealed significant differences between the two groups on the fifty-foot preferred speed walk ($F_{1,57}$=6.7, P=.01, Table 1), the fifty-foot fast speed walk ($F_{1,57}$=7.4, P=0.001, Table 2) and the distance walked in five minutes ($F_{1,57}$=10.4, P=0.001, Table 3), in favor of the second group. The second group displayed higher mean post-test scores as measured by the three physical performance measures.

Table 1. Analysis of Covariance for the Variable of Fifty-Foot Preferred Speed Walk Using the Pretest as the Covariate

	Sum of Squares	Df	Mean Square	F
Main Effects Group	77.6	1	74.6	6.7[a]
Covariate Pretest	1133.3	1	1123.3	97.5
Residual	575.3	57	10.5	
Total	10502	60	198.2	

[a]p<0.0167

Table 2. Analysis of Covariance for the Variable of Fifty-Foot Fast Speed Walk Using the Pretest as the Covariate

	Sum of Squares	Df	Mean Square	F
Main Effects Group	28.7	1	27.7	7.4[a]
Covariate Pretest	140.1	1	140.1	38.6
Residual	181.35	57	3.6	
Total	5301	60	100.01	

[a]p<0.0167

Table 3. Analysis of Covariance for the Variable of Distance Walked in Five Minutes Using the Pretest as the Covariate

	Sum of Squares	Df	Mean Square	F
Main Effects Group	2535.3	1	2535.3	10.40[a]
Covariate Pretest	314375.4	1	314375.4	1468.3
Residual	10705.2	57	214.1	
Total	10448329	60	197138.3	

[a]p<0.0167

4. Discussion

All of the participants in this report showed increase in physical function in both intervention groups, although the improvements were statistically significantly greater in the McGill group. Some authors designed specific stabilizing exercises that focus on reeducating the motor control system to activate the transversus abdominis and multifidus in patients with LBP.[12] There have been several studies investigating the effects of those exercises in different patient populations with LBP.[14-21] There have been contradictory results of these studies. In this study, participants received another program of stabilizing exercises based on measured, biomechanical factors.[9]

Improvements of participants in the McGill group can be attributed to better training of abdominal and back muscles without imposing high loads. Our results support the previous work done by Callaghan et al.[10] and Axler and McGill.[22] Those authors tested various types of therapeutic exercises and showed that McGill exercises can enhance the muscular work without high spinal loads (<3400 Newtons) in healthy subjects.

There was only one controlled-randomized trial that evaluated the effects of McGill stabilizing exercises in postnatal LBP.[23] The group that received McGill exercises had decreased pain intensity and disability compared with the control group post-treatment postpartum.

In this study, we used performance-based procedures to measure physical function. Simmonds et al. demonstrated that physical performance tests such as the fifty foot walk and distance walked in 5 minutes were reliable, valid, and able to distinguish between patients with LBP and healthy subjects.[12] Physical performance tests are objective standardized tests of physical function and are easy to demonstrate and need no equipment.[24-25] They also help control for errors in judgment, memory, and the ability to answer questions correctly.[26]

Seven participants withdrew from the study. However, the loss of participants to follow up was

associated with difficulties primarily related to scheduling the intervention sessions in both groups. No adverse effects were recorded in any of the patients in either group. Therefore, they did not withdraw due to the interventions.

In this study, self report logs were used to measure adherence of patients. Self report logs often overestimate adherence; however, they are still commonly used methods to assess adherence.[27] It should be pointed out that adherence to home exercise programs has not been adequately reported in many randomized controlled studies.[28]

There is a need to measure long-term outcomes to further substantiate the present study findings. Also, electromyography should be used to assess muscle recruitment during the performance of exercise programs. Future studies should include measuring psychological outcomes. There is also an urgent need to develop a universal classification system for LBP. Based on the results of the statistical analyses and within the limitations of the study, it can be concluded that McGill exercises may increase physical function in patients with nonspecific LBP.

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