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Original Article

Management of Musculoskeletal Disorders through the Use of Comprehensive Exercise Therapy

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Keywords
Exercise therapy; Disease management; Musculoskeletal disorders

Abstract

Background: A wide range of interventional strategies such as surgery, drug therapy, and non-medical interventions have been reported as management protocols among patients with musculoskeletal disorders (MSDs). Exercise therapy (ET) usually improves the functional status of patients with MSDs and helps them to better handle their life. The present case-control study was performed to assess the impact of comprehensive ET on the management of patients with MSDs.

Methods: The present case-control study was conducted on 123 patients with MSDs between January 2014 and January of 2015. A study checklist was prepared by the researchers to gather data regarding the medical history and physical examinations of the study participants. Moreover, the demographic variables, referral reasons, resting systolic and diastolic blood pressure, and drug history of the participants were recorded in the checklist. A blood sample was taken after 12–14 hours of fasting to measure the fasting blood sugar, serum lipids including triglycerides (TG), total cholesterol (TC), as well as high and low density lipoproteins (HDL and LDL) of the study participants. All tests were performed at the beginning of the study and after completion of the ET protocol. The ET program comprised 24 exercise sessions scheduled over 8 weeks.

Results: Body mass index (BMI), triglycerides, and mean subcutaneous fat thicknesses of quadriceps, triceps, and the suprailiac region significantly decreased among the participants as a result of the ET protocol.

Conclusion: The ET protocol had significant impacts on clinical characteristics of patients with MSDs. The performance of multicentric studies with higher sample size is suggested for the better assessment of ET protocol. Moreover, the use of ET as a part of MSD management is recommended.

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Introduction

Musculoskeletal disorders (MSDs) including osteoarthritis,[1] rheumatoid arthritis,[2] fibromyalgia,[3] low back pain,[4] pelvic pain[5] and lateral epicondylitis[6] have been reported as major causes of morbidity[7] and associated with significant limitations in the function of

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the patients.[8] Moreover, these disorders have long-term impacts on health status and quality of life (QOL) of patients.[7,9] In recent years, sedentary lifestyle has been associated with increased risk of chronic disorders such as diabetes mellitus (DM), cardiovascular disorders, and MSDs. Slentz et al. reported that inactivity can cause high cost for patients and societies even in the short term. In addition, lack of regular physical activity has been recognized as one of the actual causes of the many chronic disorders such as MSDs.[10]

A wide range of interventional strategies such as surgery, drug therapy, and non-medical interventions have been reported as MSD management protocol. Dunlop et al. found lack of physical activity to be common among patients with MSD and identified it as a disability risk factor.[11] Exercise therapy (ET) usually improves the level of functional status among patients with MSD and helps them to better handle their life. Exercise therapy is a general concept and can be performed in different ways, contents, and dosages for patients with MSD.[12,13] It is also the most widely used therapeutic modality in the world and might be implemented as a single treatment or be part of a multimodal or multidisciplinary treatment program.

According to widely accepted ideas, therapeutic modalities must have the highest effectiveness for patients without imposing side effects. Exercise therapy is suggested as effective medical treatment, and recent evidence has shown that, in certain situations, it has more effectiveness or additive effect among patients with chronic disorders. The present study was performed with the aim of assessing the impact of a comprehensive ET on the management of patients with MSDs.

Methods

The present case-control study was conducted on 123 patients with MSDs between January 2014 and January of 2015. Study participants were referred to the ET unit of the physical medicine and rehabilitation department in several wards, including internal medicine, surgery, pain, orthopedics, rheumatology, physical medicine and rehabilitation, and neurosurgery, of Khatamolanbia Hospital, Tehran, Iran, to receive regular exercise protocol. The study exclusion criteria included presence of acute MSD inflammation, uncontrolled metabolic disorders such as DM, unstable angina, uncontrolled hypertension, and joint-related abnormalities with spinal neural root or peripheral nerve involvement which would impact the participants' physical exercises. The study protocol was approved by the research ethical committee of Shahid Beheshti University of Medical Sciences, Tehran. Informed consent forms were obtained from all the patients.

A study checklist was prepared by the researchers to gather data regarding the medical history and physical examinations of the participants. Data were collected by trained general physicians and nurses. The participants were interviewed and data regarding their demographic variables (age, sex, height, and weight), referral reasons, resting systolic and diastolic blood pressure, and drug history were inserted into the study checklist. After 12-14 hours of fasting, a blood sample was taken to measure fasting blood sugar, serum lipids including triglycerides (TG), and total cholesterol (TC) using enzymatic colorimetric methods. High-density lipoprotein (HDL) was determined after dextran sulfate magnesium chloride precipitation of non-HDL cholesterol. Subsequently, low-density lipoprotein (LDL) was calculated according to the Friedewald formula. All tests were measured at the beginning and after completion of the study.

Exercise therapy program and follow-up: The ET program comprised 24 exercise sessions, scheduled over 8 weeks. Each session lasted 60-90 minutes and was implemented in two stages of aerobic training by an expert, and then, with ET equipment individualized to patients' characteristics, and distinct warmup, workout, and cooldown phases. The ET program was begun with a 10–20-minute warm-up, followed by 20–40 minutes of workout, and terminated with a 10-minute cooldown. The type of exercise performed during the sessions was either cycling using an ergo-meter, walking and running using a treadmill, or strength training exercise using equipment. According to the determined risk, the intensity of the exercise was calculated as ranging between 60 and 85% of the heart rate reserve (HRR). All patients received psychological and nutritional consultations. Subcutaneous fat thickness on triceps, quadriceps, and suprailiac regions were measured using a caliper (Mitutoyo, Andover, UK) according to standard protocols before and after ET. Moreover, abdomen, hip, arm, and thigh circumferences were measured using a measuring tape (Seca, USA) before and after the ET program. All laboratory tests were reconducted at the end of the study for those patients who completed the ET program.

Statistical analysis: The collected data were analyzed in SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA). Qualitative variables were presented as frequency and percentage and quantitative variables were presented as mean and standard deviation. To compare quantitative and qualitative variables between the two study groups, independent student t-test and chi-square test were used. All P-values of less than 0.05 were considered significant.

Results

In total, 123 patients from different wards were included in the study. The participants' mean age and body mass index (BMI) were 51.34 ± 8.11 years and 31.13 ± 5.19 kg/m^2, respectively. Mean BMI of the participants significantly decreased after the study intervention (30.13 ± 5.16 vs. 30.39 ± 4.68 kg/m^2; P < 0.001). Patients with MSDs had significantly lower serum level of triglycerides after the ET (116.90 ± 62.01 vs. 112.05 ± 26.91 mg/dl; P = 0.003).

However, no significant changes were observed in serum levels of cholesterol (201.07 ± 28.58 vs. 201.73 ± 32.93 mg/dl; P = 0.91), low-density lipoprotein (LDL) (115.13 ± 27.65 vs. 114.19 ± 34.69 mg/dl; P = 0.92), and high-density lipoprotein (HDL) (60.44 ± 12.70 vs. 54.86 ± 11.64 mg/dl; P = 0.22) after ET. No significant changes were observed in mean serum levels of aspartate transaminase (29.44 ± 21.10 vs. 27.56 ± 19.79 U/l; P = 0.49) and alanine transaminase (33.0 ± 31.70 vs. 27.83 ± 29.07 U/l; P = 0.33) after ET.

The patients' mean subcutaneous fat thicknesses of quadriceps (58.35 ± 11.99 vs. 54.55 ±10.37 mm; P < 0.001) and triceps (39.98 ± 7.65 vs. 36.62 ± 7.09 mm; P < 0.001) significantly decreased after the study intervention. Furthermore, the participants' suprailiac subcutaneous fat thickness had significantly decreased after ET (56.93 ± 10.35 vs. 53.13 ±9.63 mm; P < 0.001). Moreover, mean abdominal (106.29 ± 10.98 vs. 103.97 ± 10.77 cm; P < 0.001) and waist (94.31 ± 10.69 vs. 92.48 ± 9.64 cm; P < 0.001) circumferences significantly decreased after ET among the participants. A decrease was also observed in the mean hip circumference of the participants (112.05 ± 9.85 vs. 109.89 ± 8.89 cm; P < 0.001) (Table 1).

Discussion

The present study was performed to assess the impact of ET on the management of patients with MSDs. Exercise therapy protocol, as the study intervention, significantly decreased BMI, triglycerides and mean subcutaneous fat thicknesses of quadriceps, triceps, and the suprailiac region, and abdominal, waist, and hip circumferences among the study participants. No significant changes were seen in the other study variables, including serum levels of cholesterol, LDL and HDL, and both liver transaminases after the study intervention.

In recent years, most studies have been focused on the use of exercise-based protocols in the management of some chronic diseases. Today, exercise is suggested for the management of most of these disorders.[14,15]

Table 1. Comparison of study variables before and after the study intervention among the participants

Study variable	Before the intervention	After the intervention	P*
BMI (kg/m^2)	31.13 ± 5.16	30.39 ± 4.68	< 0.001
Triglyceride (mg/dl)	142.81 ± 57.55	135.63 ± 44.09	0.510
Cholesterol (mg/dl)	201.07 ± 28.55	201.73 ± 32.94	0.910
LDL (mg/dl)	115.13 ± 27.65	114.19 ± 34.45	0.920
HDL (mg/dl)	60.64 ± 12.70	54.86 ± 11.64	0.210
AST (mg/dl)	29.44 ± 21.10	27.56 ± 19.79	0.490
ALT (mg/dl)	33.0 ± 31.70	27.83 ± 29.09	0.330
Quadriceps SC fat thickness	58.35 ± 11.99	54.55 ± 10.34	< 0.001
Triceps SC fat thickness	39.98 ± 7.65	36.62 ± 7.09	< 0.001
Suprailiac SC fat thickness	56.93 ± 10.35	53.13 ± 9.63	< 0.001
Abdominal circumference	106.29 ± 10.98	103.97 ± 10.77	< 0.001
Waist circumference	94.31 ± 10.69	92.48 ± 9.64	< 0.001
Hip circumference	112.05 ± 9.85	109.89 ± 8.89	< 0.001

LDL: Low density lipoprotein; HDL: High density lipoprotein; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; SC: Subcutaneous

*Calculated with paired sample t-test

In some cases, ET is effective by itself, but in other cases, it is added to the conventional medical treatments in order to improve patients' outcome. Based on the literature review, some randomized clinical trials have used ET protocol among patients with different MSD types. In a meta-analysis covering more than 32 clinical trials, ET protocol had impact on the alleviation of pain and improvement of physical function among patients with knee osteoarthritis.[16] Other similar studies showed that walking and strengthening exercises in the lower limbs reduce pain and disability in patients.[16-18]

The beneficial impact of pain alleviation was reported among patients with hip osteoarthritis.[19] In another systematic review, investigators reported that ET had impact on increased aerobic capacity and muscle strength in patients with rheumatoid arthritis.[20,21] Takken et al. also found that ET protocols had impact on the improvement of functional ability among young patients with juvenile idiopathic arthritis.[22]

Hayden et al. reported that ET protocols did not have greater effectiveness than no-exercise therapeutic regimens in non-specific acute low back pain.[23] According to recent evidence, among patients with non-specific chronic low back pain, ET protocol is effective in improving pain outcomes.[23] In addition to these studies, another meta-analysis reported that condition-specific functional outcomes improvement through ET in patients with chronic low back pain was small. In another study on patients with fibromyalgia, aerobic exercise was shown to increase physical function and global well-being, as well as to improve pain and possibly tender point pressure threshold.[24] It seems that individually designed strengthening programs are effective in the health care setting.[23]

Conclusion

Findings of the present study showed that ET protocol had some significant beneficial impacts on the management of patients with chronic MSD. It seems that the ET protocol had an important role in the primary and secondary prevention of several chronic diseases including MSDs. Noted significant health benefits of ET protocol are related to its suitable time of use, and its modality and intensity. Most ET characteristics must be individualized base on each patient's nature. Presently, due to the sedentary lifestyle of the general population, and especially patients with MSDs, and thus, with restricted movement, physicians have recommended more activity in these patients and have suggested ET as one of the main parts of their disease management.

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None

Conflict of Interest

Authors have no conflict of interest.

References

1. Lluch GE, Nijs J, Torres-Cueco R, Lopez CC. Pain treatment for patients with osteoarthritis and central sensitization. Phys Ther 2013; 93(6): 842-51.
2. Meeus M, Nijs J. Central sensitization: A biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome. Clin Rheumatol 2007; 26(4): 465-73.
3. Staud R. Evidence of involvement of central neural mechanisms in generating fibromyalgia pain. Curr Rheumatol Rep 2002; 4(4): 299-305.
4. Roussel NA, Nijs J, Meeus M, Mylius V, Fayt C, Oostendorp R. Central sensitization and altered central pain processing in chronic low back pain: Fact or myth? Clin J Pain 2013; 29(7): 625-38.
5. Kaya S, Hermans L, Willems T, Roussel N, Meeus M. Central sensitization in urogynecological chronic pelvic pain: A systematic literature review. Pain Physician 2013; 16(4): 291-308.
6. Fernandez-Carnero J, Fernandez-de-Las-Penas C, de la Llave-Rincon AI, Ge HY, Arendt-Nielsen L. Widespread mechanical pain hypersensitivity as sign of central sensitization in unilateral epicondylalgia: A blinded, controlled study. Clin J Pain 2009; 25(7): 555-61.
7. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2012; 380(9859): 2163-96.
8. Reid KJ, Harker J, Bala MM, Truyers C, Kellen E, Bekkering GE, et al. Epidemiology of chronic non-cancer pain in Europe: narrative review of prevalence, pain treatments and pain impact. Curr Med Res Opin 2011; 27(2): 449-62.
9. Landmark T, Romundstad P, Borchgrevink PC, Kaasa S, Dale O. Associations between recreational exercise and chronic pain in the general population: Evidence from the HUNT 3 study. Pain 2011; 152(10): 2241-7.
10. Slentz CA, Houmard JA, Kraus WE. Exercise, abdominal obesity, skeletal muscle, and metabolic risk: evidence for a dose response. Obesity (Silver Spring) 2009; 17(Suppl 3): S27-S33.
11. Dunlop DD, Semanik P, Song J, Manheim LM, Shih V, Chang RW. Risk factors for functional decline in older adults with arthritis. Arthritis Rheum 2005; 52(4): 1274-82.
12. Edwards I, Jones M, Carr J, Braunack-Mayer A, Jensen GM. Clinical reasoning strategies in physical therapy. Phys Ther 2004; 84(4): 312-30.
13. Rothstein JM, Echternach JL, Riddle DL. The Hypothesis-Oriented Algorithm for Clinicians II (HOAC II): A guide for patient management. Phys Ther 2003; 83(5): 455-70.
14. Oldridge N, Guyatt G, Jones N, Crowe J, Singer J, Feeny D, et al. Effects on quality of life with comprehensive rehabilitation after acute myocardial infarction. Am J Cardiol 1991; 67(13): 1084-9.
15. Roberts CK, Barnard RJ. Effects of exercise and diet on chronic disease. J Appl Physiol (1985) 2005; 98(1): 3-30.
16. Fransen M, McConnell S, Bell M. Exercise for osteoarthritis of the hip or knee. Cochrane Database Syst Rev 2003; (3): CD004286.
17. Roddy E, Zhang W, Doherty M. Aerobic walking or strengthening exercise for osteoarthritis of the knee? A systematic review. Ann Rheum Dis 2005; 64(4): 544-8.
18. Lange AK, Vanwanseele B, Fiatarone Singh MA. Strength training for treatment of osteoarthritis of the knee: a systematic review. Arthritis Rheum 2008; 59(10): 1488-94.
19. Hernandez-Molina G, Reichenbach S, Zhang B, Lavalley M, Felson DT. Effect of therapeutic exercise for hip osteoarthritis pain: Results of a meta-analysis. Arthritis Rheum 2008; 59(9): 1221-8.
20. Kettunen JA, Kujala UM. Exercise therapy for people with rheumatoid arthritis and osteoarthritis. Scand J Med Sci Sports 2004; 14(3): 138-42.
21. Metsios GS, Stavropoulos-Kalinoglou A, Veldhuijzen van Zanten JJ, Treharne GJ, Panoulas VF, Douglas KM, et al. Rheumatoid arthritis, cardiovascular disease and physical exercise: A systematic review. Rheumatology (Oxford) 2008; 47(3): 239-48.
22. Takken T, van Brussel M, Engelbert RH, Van der Net J, Kuis W, Helders PJ. Exercise therapy in juvenile idiopathic arthritis. Cochrane Database Syst Rev 2008; (2): CD005954.
23. Hayden JA, van Tulder MW, Malmivaara A, Koes BW. Exercise therapy for treatment of non-specific low back pain. Cochrane Database Syst Rev 2005; (3): CD000335.
24. Busch AJ, Barber KA, Overend TJ, Peloso PM, Schachter CL. Exercise for treating fibromyalgia syndrome. Cochrane Database Syst Rev 2007; (4): CD003786.