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Is Aquatic Physical Therapy a Feasible Treatment for Musculoskeletal Dysfunction of Sickle Cell Disease Patients?

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Abstract

Physical therapy is an adjunct measure for treating osteo-articular disorders, with the objective of minimizing pain and limiting the progression of the disorder, thus improving functional capacity and quality of life of the patient. The aim of this short review is to describe the common techniques used for aquatic physical therapy and to comment a pilot study, comparing this technique to land-based physical therapy on musculoskeletal dysfunction of sickle cell disease patients. The results suggest that physical therapy is efficient, irrespective of the technique; however, aquatic therapy showed a trend towards an improvement in muscle strength. This preliminary report encourages further studies with a larger patient sample and longer periods of therapy.

Introduction

Physical therapy in association with proper medical care can avoid serious injuries brought on by osteo-articular disorders and which can result in functional limitation. Thus, physiotherapeutic intervention should take into account several aims, such as, relief of pain, prevent muscle atrophy, improve muscle strength, and increase of articular range of motion. Additionally, other benefits, such as functional capacity and quality of live can be improved through the execution of an adequate therapeutic program. Amongst the existing physical therapy recourses, aquatic and land physical therapy can be considered to be a growing resource with several benefits and tailored to the daily life of each patient. The aquatic technique uses warmed pools for therapeutic ends and is a widely used as a resource for the rehabilitation of several pathologies [1-7]. The benefits provided by the aquatic environment have mostly to do with the physical properties of the water, such as buoyant forces, hydrostatic pressure and viscosity, which exert therapeutic and physiological properties upon the immersed body [8,9]. The physical properties and the warmed water play an important role in the improvement and maintenance of the range of motion of the articulations, reducing muscle tension, promoting relaxation and preparing the conjunctive tissue for stretching. The combination of the reduction of impact induced by fluctuation together with the muscle-skeletal relaxation helps increase flexibility and mobility. Exercises carried out in an aquatic environment are an excellent option for rehabilitation as the decreased action of gravity enables easier movements and provides benefits such as increase in muscle strength, postural balance and flexability [8,9]. Acquatic physical therapy has a number of specific protocols, such as Bad Ragaz, Watsu and Halliwick, and can incorporate swimming and water aerobics into the program.

Bad ragaz

Bad Ragaz is the name of a city located in Switzerland; set amongst natural springs of thermal water, this city was already a popular spa and health resort in 1930, when the three existing pools at the time, began to be used for exercise. In 1957 the original technique employed in the "Bad Ragaz" method was developed by Dr. Knupfer in Germany. Initially, the purpose of the technique was to stabilize the trunk and extremities, and perform exercises to strengthen the muscles. These exercises were initially performed in the horizontal plane, using floaters on the neck, hips and ankles. The technique was later perfected to adapt to anatomical planes and diagonal movements, with stabilization and resistance carried out by the therapist. This technique can be used for several neurological, rheumatic and orthopedic pathologies, with the intention of decreasing muscle tone, promoting muscle strengthening, improving range of movement, stabilizing trunk and preparing for gait training [10,11].

Watsu

This technique was created in 1980 by Harold Dull as a form of massage in the water. The technique uses passive stretching, mobilization of the articulations and relaxation of the floating patient [12].

Halliwick

This method was developed by James McMillan in 1949 at Halliwick School for Girls in Southgate, London. Initially the method emphasized independence in the water. Later on, other techniques were added to the method; laying down a number of principles for the use of the method, such adaptation to the aquatic environment, restoring balance, inhibiting pathological postural patterns and facilitation [13].

Sickle cell disease

Sickle cell anemia is a genetic disorder caused by a mutation in a gene on chromosome 11, resulting in the conversion of a glutamic acid to a valine at position 6 of N-Terminal resulting in Hemoglobin S (HbS), instead of normal hemoglobin denominated Hemoglobin A (HbA), with consequent physical-chemical modifications of the hemoglobin molecules. These molecules may undergo polymerization, causing erythrocytes to sickle, leading to a decrease in the mean life span of erythrocytes, vasoocclusion, and episodes of pain and organ injury [14].

The main complications of sickle cell anemia are vaso-occlusive

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crisis, characterized by recurrent pain episodes, secondary to *mechanical microcirculatory obstruction* of sickled erythrocytes, as these cells are more dense and rigid than normal red blood cells, increase in the adherence of these erythrocytes to vascular endothelial cells and activation of endothelial cells, leukocytes and platelets [15-18]. Vaso-occlusive crises may cause ischemia, bone infarction, reperfusion injury (ischemia, hypoxia, and reoxygenation), inflammation of multiple organs, thrombosis and oxidative stress [15]. Bone pain in sickle cell disease, both in acute cases and in painful vaso-occlusive crisis, may cause chronic and progressive deficiencies, such as avascular necrosis. Vaso-occlusive crisis tend to be recurrent and affect practically all sickle cell disease patients throughout their lives [16]. Back pain and osteonecrosis of the femoral head figure among the main complaints described by sickle disease patients [19-21]. The most common sites for osteonecrosis are femoral head, followed by humerous, knees and multiple small joints in the hands and feet. The impairment of the several joints is common and over 50% of the patient's present bilateral hip pain. Symptomatic patients complain of limitation of movement and of pain, occasionally even at rest [16].

According to recent studies, life expectancy of sickle cell disease patients has improved dramatically over the last century [22]. For this reason, individuals with sickle cell disease are living longer, and with age become prone to developing progressive organ injuries, including osteoarticular diseases [23].

Thus, chronic pain should be considered a serious public health problem, negatively impacting the quality of life of these individuals. For this reason, a therapeutic plan with using several techniques and resources which help to reduce pain, improve mobility and rehabilitation of osteo articular dysfunctions, thus favoring the quality of life of these individuals [24].

Studies in literature on the role of physical therapy as a resource to prevent and treat dysfunctions of the musculoskeletal system of sickle cell individuals are scarce. One of these studies compared the efficiency of physical therapy alone to the surgical technique of decompression of the femoral head associated to physiotherapy in sickle cell patients with osteonecrosis of the femoral head [25]. The results showed no difference between the techniques, suggesting that physical therapy alone seemed to be just as efficient as surgery associated to physical therapy to improve patient hip function, delaying the need for further surgery. Therefore this study aimed to evaluate the effects of two different physical therapy programs upon musculoskeletal dysfunctions caused by sickle cell disease, with the intent of minimizing pain and improving patient function.

We previously compared the effect of aquatic and land-based physical therapy in reducing musculoskeletal hip and lower back pain and increasing overall physical capabilities of sickle cell disease patients [26,27].

Ten patients were randomized into two groups: aquatic physical therapy with a mean age of 42 years (range: 25–67), and conventional land physical therapy with a mean age of 49 years (range: 43–59). Both groups were submitted to a twelve-week program of two weekly sessions. After intervention, significant improvement was observed regarding the Lequesne index (p-value = 0.0217), Oswestry Disability Index (p-value = 0.0112), range of motion of trunk extension (p-value = 0.0320), trunk flexion muscle strength (p-value = 0.0459), hip extension and abduction muscle strength (p-value = 0.0062 and p-value = 0.0257, respectively). Range of motion of trunk and hip flexion, extension, adduction and abduction, trunk extensor muscle strength and all surface electromyography variables showed no significant statistical difference between the two groups.

We then concluded that physical therapy is efficient to treat musculoskeletal dysfunctions in sickle cell disease patients, irrespective of the technique; however, aquatic therapy showed a trend towards a better improvement of muscle strength. This preliminary report encourages further studies with a larger patient sample and longer periods of therapy.

Other studies in the literature compared the results of water exercises with land exercises in patients with hip and/or knee dysfunctions and observed no significant differences between the rehabilitation strategies, demonstrating that both techniques were efficient [3,4].

Several studies in the literature revealed an improvement in trunk muscle strength after specific exercises on land and in water [1,6,28,29]. One of these studies was carried out by Baena-Beato, who evaluated the effects of different program frequencies (two or three weekly sessions) of aquatic therapy for patients with lumbar pain [6]. The results showed that eight weeks were sufficient to decrease lumber pain levels and improve quality of life and functionality. This same study evaluated the effect of dose-response of a few parameters. Increased benefits were attained when exercises were carried out three times a week, instead of twice a week. Freitas in another study compared the effects of two weekly sessions of trunk strengthening on land for three months for patients with chronic lumbar pain and observed a significant improvement of muscle strength and of functional incapacities after the intervention [28].

Studies by Jigami also evaluated the effects of therapeutic exercise (water and land) during ten sessions, after one week and after two weeks, on quality of life of individuals with hip osteoarthritis and observed an improvement in functional and muscle strength of the inferior limbs in both groups (water and land) even in the case of weekly sessions [4].

Conclusion

An exercise program should not only be curative, the program should aim to maintain the clinical picture preventing disease progression and incapacities associated to the related disorder. In the rehabilitation context, an exercise program should necessarily aim to prevent loss of muscle strength, maintain flexibility and functionality, control pain and avoid deformities.

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References

1. Barker AL, Talevski J, Morello RT, Brand CA, Rahmann AE, et al. (2014) Effectiveness of aquatic exercise for musculoskeletal conditions: a meta-analysis. Arch Phys Med Rehabil 95: 1776-1786.

2. Frohman AN, Okuda DT, Beh S, Treadaway K, Mooi C, et al. (2015) Aquatic training in MS: neurotherapeutic impact upon quality of life. Ann Clin Transl Neurol 2: 864-872.

3. Batterham SI, Heywood S, Keating JL (2011) Systematic review and meta-analysis comparing land and aquatic exercise for people with hip or knee arthritis on function, mobility and other health outcomes. BMC Musculoskelet Disord 12: 123.

4. Jigami H, Sato D, Tsubaki A, Tokunaga Y, Ishikawa T, et al. (2012) Effects of weekly and fortnightly therapeutic exercise on physical function and health-related quality of life in individuals with hip osteoarthritis. J Orthop Sci 17: 737-44.

5. Cecchi F, Pasquini G, Paperini A, Boni R, Castagnoli C, et al. (2014) Predictors of response to exercise therapy for chronic low back pain: result of a prospective study with one year follow-up. Eur J Phys Rehabil Med 50: 143-151.

6. Baena-Beato PA, Arroyo-Morales M, Delgado-FernÃ¡ndez M, Gatto-Cardia MC, Artero EG (2013) Effects of different frequencies (2-3 days/week) of aquatic therapy program in adults with chronic low back pain. A non-randomized comparison trial. Pain Med 14:145-58.

7. Ariyoshi M, Sonoda K, Nagata K, Mashima T, Zenmyo M, et al. (1999) Efficacy of aquatic exercises for patients with low-back pain. Kurume Med J 46: 91-96.

8. Torres-Ronda L, Del Alcázar XS (2014) The Properties of Water and their Applications for Training. J Hum Kinet 44: 237-248.

9. Caromano FA, Themudo MRFF, Candeloro JM (2003) Efeitos fisiolÃ³gicos da imersÃ£o e do exercÃcio na Ã¡gua. Rev Fisioter Bras 4:126-9.

10. Campion MR (1990) Adult hydrotherapy: A practical approach. Oxford, England: Heinem Medical Books 4e5:199-239.

11. Cinningham J (1994)Applying Bad Ragaz method to the orthopedic client. Orthopedic Physical Therapy Clinics in North America 251-260.

12. Dull H(1993) Freeing the Body in Water. Middle-town, Calif: Harbin Springs Publishing.

13. Morris DM (1994) Aquatic rehabilitation for the treatment of neurological disorders. J Back Musculoskelet Rehabil 4: 297-308.

14. Baldanzi G, Traina F, Marques Neto JF, Santos AO, Ramos CD, et al. (2011) Low bone mass density is associated with hemolysis in Brazilian patients with sickle cell disease. Clinics (Sao Paulo) 66: 801-805.

15. Serarslan Y, Kalaci A, Ozkan C, DoÄŸramaci Y, Cokluk C, et al. (2010) Morphometry of the thoracolumbar vertebrae in sickle cell disease. J Clin Neurosci 17: 182-186.

16. Almeida A, Roberts I (2005) Bone involvement in sickle cell disease. Br J Haematol 129: 482-490.

17. Claster S, Vichinsky EP (2003) Managing sickle cell disease. BMJ 327: 1151-1155.

18. Rosse WF, Narla M, Petz LD, Steinberg MH (2000) New Views of Sickle Cell Disease Pathophysiology and Treatment. Hematology Am Soc Hematol Educ Program .

19. Huo MH, Friedlaender GE, Marsh JS (1990) Orthopaedic manifestations of sickle-cell disease. Yale J Biol Med 63: 195-207.

20. Milner PF, Joe C, Burke GJ (1994) Bone and joint disease. In: Embury SH, Hebbel RP, Mohandas N, Steinberg MH. Sickle cell disease: basic principles and clinical practice.: Raven Press, New York.

21. Akinyoola AL, Adediran IA, Asaleye CM, Bolarinwa AR (2009) Risk factors for osteonecrosis of the femoral head in patients with sickle cell disease. Int Orthop 33: 923-926.

22. Sheth S, Licursi M, Bhatia M (2013) Sickle cell disease: time for a closer look at treatment options? Br J Haematol 162: 455-464.

23. Osunkwo I (2013) An update on the recent literature on sickle cell bone disease. Curr Opin Endocrinol Diabetes Obes 20: 539-546.

24. Ohara DG, Ruas G, Castro SS, Martins PR, Walsh IA (2012) Musculoskeletal pain, profile and quality of life of individuals with sickle cell disease. Rev Bras Fisioter 16: 431-438.

25. Neumayr LD, Aguilar C, Earles AN, Jergesen HE, Haberkern CM, et al (2006). Physical therapy alone compared with core decompression and physical therapy for femoral head osteonecrosis in sickle cell disease. Results of a multicenter study at a mean of three years after treatment. J Bone Joint Surg Am 88: 2573-2582.

26. zanoni CT, GalvÃ£o F, Cliquet Junior A, Saad ST (2015) Pilot randomized controlled trial to evaluate the effect of aquatic and land physical therapy on musculoskeletal dysfunction of sickle cell disease patients. Rev Bras Hematol Hemoter 37: 82-89.

27. Zanoni CT (2014) Ensaio clÃnico randomizado para avaliaÃ§Ã£o do efeito de dois programas de fisioterapia nas disfunÃ§Ãµes musculoesquelÃ©ticas de portadores de doenÃ§a falciforme [Tese]. Campinas: UNICAMP-FCM.

28. Freitas CD de, Greve JMD (2008) Estudo comparativo entre exercÃcios com dinamÃ´metro isocinÃ©tico e bola terapÃªutica na lombalgia crÃ´nica de origem mecÃ¢nica. Fisioter. Pesqui. 15:380-386.

29. Carpenter DM, Nelson BW (1999) Low back strengthening for the prevention and treatment of low back pain. Med Sci Sports Exerc 31: 18-24.