FUNCTIONAL EXERCISE ON PATIENTS' REHABILITATION WITH PSOAS MUSCLE SPORTS INJURIES

EXERCÍCIO FUNCIONAL NA REABILITAÇÃO DE PACIENTES COM LESÃO ESPORTIVA DO MÚSCULO PSOAS

EJERCICIO FUNCIONAL EN LA REHABILITACIÓN DE PACIENTES CON LESIÓN DEPORTIVA DEL MÚSCULO PSOAS

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ABSTRACT

Introduction: Lumbar muscle strain is a chronic injury to soft tissues such as the lumbar muscles, ligaments, and fascia. Functional exercise has specific applications in treating lumbar muscle injuries caused by sports. However, analyses on the treatment results in the psoas muscle are inconclusive. Objective: Analyze the clinical efficacy of functional exercise in treating psoas muscle dysfunction. Methods: 10 athletes diagnosed with lumbar muscle strain received continuous training with a functional exercise protocol for two weeks, five times a week. Clinical efficacy was assessed by visual analog scale for pain score and Prokin254 for proprioception ability indices before and after treatment. The article adopts a mathematical statistics analysis method to analyze the therapeutic effect of motor function exercise with SPSS 13.0. Results: Patients reported a reduction of pain in the muscles under exertion after functional exercise. The results were significantly different (P<0.05). Patients' lumbar strength was significantly improved. This index has a considerable statistical difference (P<0.05). Conclusion: Functional exercise showed a positive effect on the treatment of psoas muscle injury. The research results of this article can provide an effective training protocol for the rehabilitation of people with a psoas muscle strain. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Psoas Muscles; Athlete; Sports; Human Physical Training.

RESUMO

Introdução: A tensão muscular lombar é uma lesão crônica dos tecidos moles, tais como músculos lombares, ligamentos e fáscia. O exercício funcional tem certas aplicações no tratamento de lesões musculares lombares ocasionadas pelo esporte. Porém, as análises na intensidade dos resultados do tratamento no músculo psoas são inconclusivas. Objetivo: Analisar a eficácia clínica do exercício funcional no tratamento da disfunção no músculo psoas. Métodos: 10 atletas com diagnóstico de estiramento muscular lombar receberam treinamento contínuo com protocolo de exercícios funcionais por 2 semanas, 5 vezes por semana. A eficácia clínica foi avaliada pela escala analógica visual de score de dor e Prokin254 para índices de capacidade de propriocepção antes e depois do tratamento. O artigo adota um método de estatística matemática para analisar o efeito terapêutico do exercício da função motora com SPSS 13.0. Resultados: Pacientes relataram uma redução da dor na musculatura sob esforço após o exercício funcional. Os resultados foram significativamente diferentes (P<0,05). A força lombar dos pacientes foi significativamente aprimorada. Esse índice tem diferença estatística considerável (P<0,05). Conclusão: O exercício funcional revelou um efeito positivo sobre o tratamento da lesão muscular do psoas. Os resultados da pesquisa deste artigo podem fornecer um protocolo eficaz de treinamento para a reabilitação de pessoas com tensão do músculo psoas. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Músculo Psoas; Atleta; Esportes; Condicionamento Físico Humano.*

RESUMEN

Introducción: La distensión muscular lumbar es una lesión crónica de los tejidos blandos como los músculos lumbares, los ligamentos y la fascia. El ejercicio funcional tiene ciertas aplicaciones en el tratamiento de las lesiones musculares lumbares causadas por el deporte. Sin embargo, los análisis sobre la intensidad de los resultados del tratamiento en el músculo psoas no son concluyentes. Objetivo: Analizar la eficacia clínica del ejercicio funcional en el tratamiento de la disfunción del músculo psoas. Métodos: 10 atletas con diagnóstico de distensión muscular lumbar recibieron un entrenamiento continuo con un protocolo de ejercicios funcionales durante 2 semanas, 5 veces por semana. La eficacia clínica se evaluó mediante la escala analógica visual para la puntuación del dolor y el Prokin254 para los índices de capacidad de propiocepción antes y después del tratamiento. El artículo adopta un método estadístico matemático para analizar el efecto terapéutico del ejercicio de la función motora con SPSS 13.0. Resultados: Los pacientes informaron una reducción del dolor en los músculos bajo esfuerzo después del ejercicio funcional. Los resultados fueron significativamente diferentes (P<0,05). La fuerza lumbar de los pacientes mejoró significativamente. Este índice tiene una diferencia estadística considerable (P<0,05). Conclusión: El ejercicio funcional reveló un efecto positivo en el tratamiento de la lesión del músculo psoas. Los resultados de la investigación de este artículo pueden proporcionar un protocolo de entrenamiento eficaz para la rehabilitación de personas con distensión del músculo psoas. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Músculos Psoas; Atleta; Deportes; Acondicionamiento Físico Humano.*

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INTRODUCTION

Lumbar muscle strain refers to the chronic damage of the soft tissues of the waist, such as muscles, ligaments, and fascia. Injuries can occur to athletes in any sport. The long course of the disease directly affects the athletes' daily training and competition performance.[1] Because oral drug treatment will bring the risk of accidental doping to athletes, choosing a safe and non-toxic side-effect treatment method is more acceptable to athletes. Studies have found that there are few reports of using passive exercise training to treat lumbar muscle strain. Therefore, this study used passive exercise function training to treat athletes' lumbar muscle strain and observe its clinical effects.

METHOD

Research object

All 10 athletes suffering from lumbar muscle strain were admitted to the Sports Rehabilitation Laboratory of the Institute of Sports Science.[2] There are 5 cases of the fencing team, 3 badminton team, and 2 cases of the table tennis team. The average age is (19.80±1.40) years, the average height is (174.10±11.47) cm, and the average weight is 67.70±14.02.

Research methods

We conducted passive exercise function training on 10 athletes who were diagnosed with a lumbar muscle strain. The training frequency is 5 times/week, and the continuous training time lasts for 2 weeks. The specific training method is as follows. (1) Preparation: Adjust the suspension point to be as high as the midpoint of the calf when the athlete is standing. The athlete lies on his back on the mat, with a wide sling above the knee. (2) 4 training modes: 1) Supine butt lift. Put your legs on the sling and place the upper edge of the wide sling in the popliteal fossa. Support with both arms, press down on both lower limbs and raise the pelvis with wide sling disease.[3] Tightening of the lower abdomen keeps the shoulders, hips, and knees on the same level. Athletes rest for the 30s after maintaining for 30-60s. Repeat 8~10 groups. 2) Side plate support. Put your legs on the sling and face up sideways. The upper edge of the wide sling is located at the lower edge of the patella. Lie on your upper body side on the mat. The lower upper limbs bend the elbows to support the body. Both lower limbs press down the wide sling and raise the hips to raise the pelvis. Tighten your lower abdomen and keep your head, shoulders, hips, and knees on the same level. Maintain for 30~60s and rest for the 30s. Repeat 4~5 sets and then switch to the other side and repeat 4~5 sets. 3) Plank support. Put your legs on the sling and turn and face down. The upper edge of the wide sling is located at the lower edge of the patella. The upper body lies prone on the mat. Support with elbow flexion and keep both lower limbs pressed down with a wide sling.[4] 4) Omega. Under the premise of maintaining the plank posture, retract the abdomen and levator anus. Hook your legs around the wide sling and keep your knees bent and hips flexed. The lower back is arched and maintained for 5~10s. Slowly return to the plank position. Repeat 5~8 movements. Train 5 groups in total, and rest for the 30s between groups.

Observation indicators

We evaluate the clinical efficacy of athletes after passive sports function training. At the same time, we used the visual analog scale method (VAS) to evaluate the pain score and Prokin254 to evaluate the ATE and SI proprioception ability indexes before and after training.

Evaluation of clinical efficacy

(1) Cure. The back pain disappeared, and his activities returned to normal. Volunteers can participate in training and competitions normally. (2) Significantly effective. The low back pain disappeared, and the activities returned to normal. Waist pain and discomfort in the morning were significantly reduced compared with before. Back pain does not affect training and competition. (3) Effective. The low back pain was less than before, and the activities returned to normal. After getting up in the morning, the waist pain and discomfort were less than before, but they recurred after fatigue from training. (4) Invalid. The low back pain has not been relieved or worsened than before. The total effective rate of training = cure rate + apparent rate + effective rate.

Evaluation of waist proprioception

The athlete sits in the middle of the Prokin254 inclined board. The lumbar spine is upright, and the knee joint is 90°. The greater trochanter on both sides is aligned with the A3A7 axis. Look at the front electronic display and place your hands above your knees naturally. After the test starts, the athlete uses the waist to control the blue pointer through the tilt board. After touching the red dot in the figure, the test trace process will start.[5] Draw a circle according to the blue circular trajectory given by the software. We control the movement of the tilt board to complete the evaluation in the shortest time and the best path. Obtain ATE and SI values from the test results for analysis and comparison. The lower the two values, the better the proprioception ability, and vice versa.

Athlete's waist design and sports simulation

The torque expression form of the athlete's dynamic method is shown in formula (1):

$$\dot{\tau}(t) = D(q(t)) \times \ddot{q} + h(q(t), \dot{q}(t)) + c(q(t)) \tag{1}$$

$\dot{q}(t)$ represents the equivalent column vector of the torque of each joint; $\dot{q}(t)$ represents the column vector of acceleration or angular acceleration of each joint;

$\dot{q}(t)$ represents the velocity or angular velocity column vector of each joint; $q(t)$ represents the displacement or angular displacement column vector of each joint. We ignore the Coriolis force between the joints.[6] The equal moment of force acting on each joint is the superposition of the inertial force, centrifugal force, and gravity on the joint when each joint moves separately. The simplified kinetic model is as follows:

$$\dot{\tau}(t) = D(q(t)) \times \ddot{q}(t) + h(q(t), \dot{q}(t))^2 + c(q(t)) \tag{2}$$

The simplified dynamic model of the athlete's waist mechanism can be expressed as follows:

$$\underset{w}{\tau}(t) = \begin{vmatrix} \tau_8(t) \\ \tau_9(t) \end{vmatrix} = D(q) \begin{vmatrix} \ddot{q}_8 \\ \ddot{q}_9 \end{vmatrix} + M(\ddot{q}) + h(q, \dot{q}) + G(q) + F \tag{3}$$

Statistical processing

We use SPSS13.0 statistical software for statistical processing. The collected data are expressed as mean ± standard deviation ($\overline{\chi} \pm s$). Normally distributed data were compared using a group t-test.[7] The rank-sum test was used for the comparison of skew distribution data. P<0.05 is a significant difference and statistically significant.

RESULTS

3.1 Evaluation of clinical efficacy of athletes after passive sports function training

After passive sports training, 3 cases were cured, 6 markedly effective, 1 case was effective, and 0 cases ineffective.[8] The total effective rate is 100%.

Comparison of athletes' VAS scores before and after passive sports function training

The athlete's VAS score before passive sports function training was 4.90±1.20. The VAS score after training was 1.40±1.08. The difference before and after training was statistically significant (P<0.01).

Comparison of proprioception indexes of athletes before and after passive sports function training

The ATE value of athletes before passive sports function training is 45.30±14.30. The SI value is 1.61±0.36. The ATE value after training is 31.70±5.25. The SI value is 1.17±0.15. The difference before and after training was statistically significant (P<0.05).

DISCUSSION

Lumbar muscle strain can happen to athletes in any sport. The range, amplitude, intensity, and amount of exercise of the waist of the athletes in the daily training of a large amount of exercise and high intensity and intense and intense competitive competitions are relatively large.[9] If the body is not properly protected, technical movements are not standardized, or the load is too large, it will cause acute strain of the waist muscle fiber tissue. Suppose these injuries and fatigue are not repaired in time. In that case, their repeated occurrence will gradually accumulate and lead to local connective tissue hyperplasia, muscle fiber degeneration, adhesion contracture, neurovascular injury, and other pathological changes. The scope of strain expands with the further aggravation of local fatigue and eventually causes extensive lumbar muscle strain. Waist pain is the main clinical symptom of this disease. Especially when the exercise load is excessive, it can be relieved when resting. This seriously affects the physical and mental health of athletes and the performance of training and competition levels.

Long-term repeated lumbar muscle strain will cause the athlete's waist strength to decrease. The small muscle groups around the lumbar spine that maintain core stability are insufficient, and the peripheral stabilizing muscles cannot maintain their original functions normally.[10] This leads to a decrease in the stability of the lumbar spine. When the exercise load is excessive, the core muscles are not activated. The peripheral stabilizing muscles contract excessively to maintain the body's normal posture and are in a state of overwork. This can easily aggravate the symptoms of lumbar muscle strain or cause the recurrence of lumbar muscle strain. The core stabilizing muscles play an important role in protecting the load of the lumbar spine, damping shock, and supporting the movement function of the lumbar spine. Therefore, enhancing the strength of the core stabilizing muscles will help to improve the stability of the lumbar spine and improve the quality of the lumbar muscle strain.

Passive sports function training puts the athlete in an unstable plane under the premise of removing the athlete's gravity.[11] The active cooperation of athletes to complete the required actions can effectively stimulate the motor receptors. It can activate the dormant stabilizing muscles, enhance the strength of the core stabilizing muscles, and improve the stability of the lumbar spine itself. In this study, athletes who have been diagnosed with lumbar muscle strain were treated with passive sports function training. The results of the study showed significant efficacy. After training, 10 athletes with lumbar muscle strain were cured in 3 cases, markedly effective in 6 cases, effective in 1 case, and ineffective in 0 cases. The total effective rate is 100%. After passive motor function training, the VAS score was significantly lower than the score before training (P<0.01). This is because passive sports function training can promote blood circulation in the soft tissues around the spine, accelerate the elimination of metabolites, and significantly improve athletes' low back pain symptoms.

The waist muscles, tendons, ligaments, and joint capsules are rich in proprioceptors. When lumbar muscle strain occurs, the proprioceptive ability of the waist will decrease. Decreased proprioceptive feedback leads to a decrease in lumbar spine stability. This will further cause damage to the soft tissues of the waist and form a vicious circle of repeated injuries. The maintenance of lumbar spine stability depends to a large extent on good proprioception. This study showed that athletes ATE and SI values after passive exercise function training were significantly lower than those before training (P<0.05). ATE and SI values are sensitive indicators for Prokin254 to detect proprioception. The results show that passive exercise function training can enhance the stability of the lumbar spine by improving the proprioception ability of the waist. This exercise can effectively prevent waist injuries caused during exercise.

CONCLUSION

Passive sports function training can enhance the stability of the athlete's lumbar spine by improving the proprioception ability of the waist. It can effectively prevent the injury of the athlete's waist during exercise. Passive exercise training can effectively treat sports lumbar muscle strain. It significantly relieves waist pain symptoms and improves waist proprioception. This exercise can be used as an effective training method for athletes to treat lumbar muscle strain.

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AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. XS: writing and article review. RH: data analysis.

REFERENCES

1. Salau VF, Erukainure OL, Olofinsan KA, Ijomone OM, Msomi NZ, Islam M. Vanillin modulates activities linked to dysmetabolism in psoas muscle of diabetic rats. Scientific reports. 2021;11(1):1-17.
2. Xu BY, Vasanwala FF, Low SG. A case report of an atypical presentation of pyogenic iliopsoas abscess. BMC infectious diseases. 2019;19(1):1-4.
3. Bae SJ, Lee SH. Computed tomographic measurements of the psoas muscle as a predictor of mortality in hip fracture patients: Muscle attenuation helps predict mortality in hip fracture patients. Injury. 2021;52(6):1456-61.
4. Fitzpatrick JA, Basty N, Cule M, Liu Y, Bell JD, Thomas EL et al. Large-scale analysis of iliopsoas muscle volumes in the UK Biobank. Scientific reports. 2020;10(1):1-10.
5. Huang CWC, Tseng J, Yang SW, Lin YK, Chan WP. Lumbar muscle volume in postmenopausal women with osteoporotic compression fractures: quantitative measurement using MRI. European radiology. 2019;29(9):4999-5006.
6. Honkanen T, Mäntysaari M, Leino T, Avela J, Kerttula L, Haapamäki V et al. Cross-sectional area of the paraspinal muscles and its association with muscle strength among fighter pilots: a 5-year follow-up. BMC musculoskeletal disorders. 2019;20(1):1-8.
7. Tokuyama Y, Arai M, Yamano K, Masada T, Imashuku S. Development of an Iliacus Muscle Abscess after School Exercise in a 17-Year-Old Female Student. Case Reports in Orthopedic Research. 2021;4(1):62-6.
8. Wang W, Wang X. Clinical Application of High Frequency Ultrasound in Diagnosis and Treatment of Lumbar Muscle Injury After Strenuous Exercise. Journal of Medical Imaging and Health Informatics. 2020;10(4):923-7.
9. Kim B, Yim J. Core stability and hip exercises improve physical function and activity in patients with non-specific low back pain: A randomized controlled trial. The Tohoku Journal of Experimental Medicine. 2020;251(3):193-206.
10. Burkhart K, Allaire B, Bouxsein ML. Negative effects of long-duration spaceflight on paraspinal muscle morphology. Spine. 2019;44(12):879-86.
11. Lifshitz L, Sela SB, Gal N, Martin R, Klar MF. Iliopsoas the Hidden Muscle: Anatomy, Diagnosis, and Treatment. Current Sports Medicine Reports. 2020;19(6):235-43.