EFFECTS OF NEUROMUSCULAR TREATMENT ON POSTURAL BALANCE IN ATHLETES RECOVERING FROM THE ANKLE INJURY

ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

EFEITOS DO TRATAMENTO NEUROMUSCULAR SOBRE O EQUILÍBRIO POSTURAL EM ATLETAS NA REABILITAÇÃO DE LESÃO DO TORNOZELO

EFECTOS DEL TRATAMIENTO NEUROMUSCULAR SOBRE EL EQUILIBRIO POSTURAL EN ATLETAS EN LA REHABILITACIÓN DE LESIONES DEL TOBILLO

Hongtao Liu[1]
(Physical Education Professional)

1. Shaanxi University of Technology, Hanzhong, Shaanxi, China.

Correspondence:
Hongtao Liu
Hanzhong, Shaanxi, China. 723001.
HongtaoLiu3@126.com

ABSTRACT

Introduction: Posture is directly related to body balance, and both have great importance in movement. Body posture is affected by several human body factors in space, and neuromuscular athletes' rehabilitation methods should be designed for an optimal return of postural stability. Objective: Explore the effects of neuromuscular treatment on postural balance rehabilitation of athletes' ankle injuries. Methods: 20 athletes with functional ankle instability were randomized into experimental and control groups. The experimental group received neuromuscular treatment. The control group maintained standard muscle strength and joint activity rehabilitation exercises. The effects of two rehabilitative procedures were compared by Cumberland ankle instability assessment questionnaire, T-type agility test, and Sargent vertical jump test. Results: Agility after exercise was significantly lower than those before exercise by 0.8 versus 1s; there was no significant difference between the two groups before the experiment. Agility test results of the experimental group were significantly lower than those of the control group (2s). Sargent's vertical jump test results were significantly different from those before the exercise ($P < 0.01$). Conclusion: The postural balance showed good recovery with the neuromuscular treatment and the rehabilitation method of the athletes after the ankle injury. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Exercise; Athletes; Ankle Injuries.

RESUMO

Introdução: A postura está diretamente relacionada ao equilíbrio corporal e ambos têm grande importância no movimento. A postura corporal é afetada por vários fatores do corpo humano no espaço e os métodos de reabilitação neuromuscular em atletas devem ser delineados para um retorno otimizado da estabilidade postural. Objetivo: Explorar os efeitos do tratamento neuromuscular sobre o equilíbrio postural na reabilitação de lesão no tornozelo de atletas. Métodos: 20 atletas com instabilidade funcional do tornozelo foram divididos aleatoriamente em grupo experimental e grupo controle. O grupo experimental recebeu tratamento neuromuscular, enquanto o grupo controle permaneceu com exercícios de reabilitação de força muscular e atividade articular padrão. Os efeitos de dois procedimentos de reabilitação na instabilidade funcional do tornozelo foram comparados pelo questionário de avaliação da instabilidade do tornozelo de Cumberland, teste de agilidade do tipo T e teste de salto vertical de Sargent. Resultados: Os resultados do teste t de agilidade após o exercício foram significativamente menores do que os anteriores ao exercício em 0,8 contra 1s; não houve diferença significativa entre os dois grupos antes do experimento. Os resultados dos testes de agilidade do grupo experimental foram significativamente inferiores aos do grupo controle (2s). Os resultados do teste de salto vertical de Sargent foram significativamente diferentes daqueles anteriores ao exercício ($P < 0,01$). Conclusão: O equilíbrio postural apresentou boa recuperação com o tratamento neuromuscular e com o método de reabilitação dos atletas após a lesão do tornozelo. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Exercício; Atletas; Traumatismos do Tornozelo.*

RESUMEN

Introducción: La postura está directamente relacionada con el equilibrio corporal y ambos tienen gran importancia en el movimiento. La postura corporal se ve afectada por varios factores del cuerpo humano en el espacio y los métodos de rehabilitación neuromuscular en los deportistas deben diseñarse para un retorno óptimo de la estabilidad postural. Objetivo: Explorar los efectos del tratamiento neuromuscular sobre el equilibrio postural en la rehabilitación de lesiones de tobillo en atletas. Métodos: 20 atletas con inestabilidad funcional del tobillo fueron divididos aleatoriamente en un grupo experimental y un grupo de control. El grupo experimental recibió un tratamiento neuromuscular, mientras que el grupo de control permaneció con ejercicios estándar de rehabilitación de la fuerza muscular y la actividad articular. Se compararon los efectos de dos procedimientos de rehabilitación sobre la inestabilidad funcional del tobillo mediante el cuestionario de evaluación de la inestabilidad del tobillo de Cumberland, la prueba de agilidad

tipo T y la prueba de salto vertical de Sargent. Resultados: Los resultados de la prueba t de agilidad después del ejercicio fueron significativamente inferiores a los de antes del ejercicio en 0,8 frente a 1s; no hubo diferencias significativas entre los dos grupos antes del experimento. Los resultados de la prueba de agilidad del grupo experimental fueron significativamente inferiores a los del grupo de control (2s). Los resultados de la prueba de salto vertical de Sargent fueron significativamente diferentes de los obtenidos antes del ejercicio (P < 0,01). Conclusión: El equilibrio postural mostró una buena recuperación con el tratamiento neuromuscular y con el método de rehabilitación de los atletas tras la lesión del tobillo. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Ejercicio; Atletas; Traumatismos del Tobillo.*

DOI: http://dx.doi.org/10.1590/1517-8692202228052022_0036 Article received on 01/28/2022 accepted on 02/11/2022

INTRODUCTION

Body posture is the relative position of different parts of the human body in space, or the state of human existence in space. It is one of the important contents of body. Relevant scholars and experts believe that body posture reflects the mechanical relationship between human muscles, bones, nervous system and internal organs.[1] Generally speaking, the continuous and dynamic state of the body is called human action. The static state without action is called body posture.[2] Body posture refers to the relationship between human limbs, head, trunk and other parts. The relative position of various parts of the body is also defined as body posture by scholars. Body posture is affected by the specific mechanical relationship of human muscles, bones, nervous system, internal organs and other organs and tissues. The meaning of sports injury refers to the injury and injury related to sports events in the process of sports.[3] This kind of injury and injury is related to the sports and has certain technical characteristics. The injury and injury caused in sports are often directly or indirectly related to the characteristics of sports (technical and tactical actions), the behavior of sports subjects (exercise level), objective conditions (sports environment, materials and equipment).[4-5] In this study, taking athletes with ankle sprain as an example, two different exercise methods were used to intervene athletes with ankle functional instability and observe their effects.

METHOD

Object selection and grouping

Twenty male athletes who were diagnosed as FAI and met the inclusion criteria were selected. Inclusion criteria: (1) the first diagnosis met the FAI diagnostic criteria: there was at least one obvious injury of the lateral ligament of the unilateral ankle in the past year, resulting in the inability of the affected foot to bear weight or the need to walk with crutches; No serious injury of lower limbs and no fracture of ankle; Repeated sprain of the affected limb at least once or feeling of ankle instability or weakness; The front drawer test was negative and no obvious structural instability was found. (2) Patients with right side injury, aged 18 ~ 35 years. (3) No formal or informal exercise.

Exclusion criteria: (1) patients with ankle ligament injury above II ° (including II); (2) Patients with fracture and joint dislocation; (3) Patients with exfoliative chondroititis of ankle joint; (4) Severe osteoarthritis and traumatic arthritis; (5) Patients with rheumatic diseases and metabolic diseases. Before the beginning of the study, explain the purpose of the study to all subjects. After filling in the informed consent form, a randomized single-blind experiment was adopted. They were randomly divided into experimental group and control group, with 10 cases in each group. There was no significant difference between the two groups (P > 0.05).

Literature method

Take posture and exercise methods, sports injury, etc. as key words, consult a large number of literature on sports injury, clinical guidelines for sports injury, prevention and treatment of sports injury, rehabilitation of sports injury and other related theoretical knowledge system disciplines, and obtain the theoretical basis related to this study after understanding and analysis.[6]

Exercise mode scheme

Exercise for 6 weeks: (1) experimental group: neuromuscular training, including balance exercise, dynamic ankle stability exercise, plyometric exercise, sensitivity exercise and balance exercise; (2) Control group: exercise the strength of calf and foot muscles mainly through ankle varus and valgus, back extension and plantar flexion, and combined with joint range of motion. Exercise 3 times a week, each time for no less than 50 minutes.

Evaluation and testing

1. Cumberland ankle instability questionnaire (CAIT). CAIT questionnaire contains 9 questions to evaluate patients' subjective feelings at ankle joint in different types of daily activities such as walking, running, going up and down stairs and jumping. The total score of 9 questions is 0 ~ 30 points, with 27.5 as the dividing point: 28 points or above indicate that the tested ankle has not been sprained and there is no functional ankle instability; A score of 27 or below indicates that the tested ankle may have functional ankle instability. The lower the score, the worse the stability of the tested ankle. This questionnaire can not only distinguish whether the ankle is stable or not, but also measure the degree of functional instability of the tested ankle.[7]

2. Star extensional balance tests (SEBT). The specific test methods of SEBT are as follows: measure the length of the right lower limb of the subject in lying position; All subjects were asked to practice four times in four directions, and then rest for 5min to prepare for the formal test. During the test, put your hands in your waist and stand on one leg in the center of the 8-point star diagram. At the beginning of the test, bend the knee of the supporting leg and extend the non supporting leg as far as possible in four directions separated by 45 °. The four directions are anterior (ANT), anterolateral (ALAT), lateral (LAT) and posterolateral (plat). Test in a clockwise direction. Before moving to the next direction each time, move the extended leg back to the center of the circle, return to standing on both feet, and rest for 3S, so as not to affect the body balance and reduce the accuracy of the test.

3. T-type agility t-test. Design a T-shaped test path with width and length equal to 91.4cm (10yards), start from the starting point of the bottom line, quickly run along the T-shaped path, complete the turn, and finally return to the starting point. Avoid stepping on the line during the test, test 3 times continuously, record the time (s) used to complete the test respectively, and take the mean value.

Statistical analysis

SPSS17.0 statistical software package is used for data processing, and the measurement data are expressed in. Independent samplesttest was used for comparison between groups. Paired samplesttest was used for comparison before and after exercise for the same subject in the group. $P < 0.05$ is a significant difference, $P < 0.01$ is a very significant difference.

RESULTS

Cait score

There was no significant difference between the two groups before exercise ($P > 0.05$). The CAIT scores of the two groups after exercise were significantly higher than those before exercise ($P < 0.01$). After exercise, the score of the experimental group was significantly higher than that of the control group ($P < 0.01$). (Table 1)

SEBT results

The SEBT results of the control group in four test directions after exercise were significantly higher than those before exercise ($P < 0.01$); After exercise, the results of SEBT in the control group were significantly higher than those in the experimental group in the directions of plat, post, pmed, Med and Amed ($P < 0.01$). (Table 2)

Agility test results

The results of agility t-test after exercise were significantly lower than those before exercise by 0.8 ~ 1s; There was no significant difference between the two groups before exercise. After exercise, the agility t-test results of the experimental group were significantly lower than those of the control group for 2S. (Figure 1)

Table 1. Comparison of CAIT scores between the two groups before and after exercise.

Group	n	Before exercise	After exercise
Control Group	10	15.30±1.53	21.00±1.25
Experience Group	10	14.82±1.25	23.70±1.01

Table 2. Comparison of SEBT test standardization between the two groups before and after rehabilitation training.

Direction	Group	n	Before exercise	After exercise
ANT	Control Group	10	62.00±5.66	62.25±6.44
	Experience Group	10	60.82±5.16	60.03±7.54
ALAT	Control Group	10	59.65±7.25	60.03±7.54
	Experience Group	10	58.40±7.26	64.57±7.50
LAT	Control Group	10	56.75±7.53	56.78±7.07
	Experience Group	10	54.11±9.62	60.60±9.45
PLAT	Control Group	10	59.23±5.62	59.22±1.61
	Experience Group	10	59.18±5.60	68.65±5.58

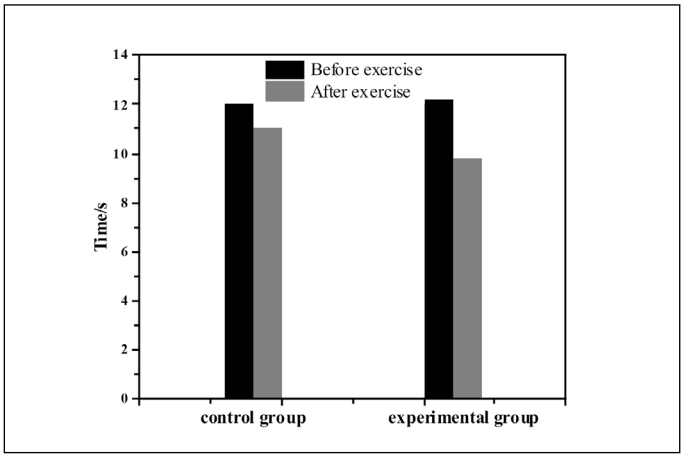

Figure 1. Comparison of agility t-test before and after exercise in the two groups.

Table 3. Comparison of Sargent / vertical jump test effective coefficient between the two groups before and after exercise.

Group	n	Before exercise	After exercise
Control Group	10	28.68±1.15	30.87±1.30
Experience Group	10	28.53±1.41	30.65±1.31

target/verticaljumptest results

The results of Sargent / vertical jump test after exercise were significantly higher than those before exercise ($P < 0.01$); There was no significant difference between the two groups before and after exercise ($P > 0.05$). (Table 3)

DISCUSSION

Principle analysis of the application of posture in ankle instability

For the local transition load caused by body posture and, the best way is to restore the normal arrangement and action mode of body mechanisms through some targeted corrective exercises, so as to alleviate the local transition load and achieve the purpose of rehabilitation and injury prevention.[8] Usually, the examination and evaluation of sports injury is mainly judged by the examination of athletes' muscle strength and joint range of motion.

SEBT evaluation method

SEBT can evaluate limb balance and dynamic neuromuscular control, as well as limb endurance, flexibility and proprioception. The test only needs 4 tape measures and a hard ground, and there is no need for expensive testing instruments or measuring tools. By testing the extension length of lower limb function in different directions, the stability and balance function of lower limb in different directions were evaluated. SEBT requires one leg standing balance, and the maximum extension of the opposite leg enables a wide range of activities of the ankle, knee and hip. This dynamic balance test is better than the static balance test.[9]

T agility test

Agility includes the ability to change direction rapidly. Ankle injury often impairs agility. A comprehensive test program should include exercise needs, cognitive processes and motor skills. When choosing agility test items, we must also consider different sports and appropriate locations. T-type agility test has been proved to have high reliability. The classic completion time of athletes is usually between 8.9 and 13.5 seconds.[10] The results of this study show that two different exercise methods and procedures improve the T-type agility test results of FAI athletes, and the neuromuscular exercise method group is idealThe improvement of this cognitive ability can not only improve the athletes' sports ability, but also effectively prevent the recurrence of injury.

CONCLUSION

In competitive sports, ankle injury is a very common sports injury. If reasonable functional exercise can be carried out in the recovery period of injury, the injured joint can recover quickly. Body posture and two different exercise methods can improve the ankle function of FAI athletes, improve their limb agility, and develop lower limb strength and speed; Neuromuscular exercise has better effect, enhances balance control ability, and speeds up the recovery of limb function after sports joint injury.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. HL: writing and performing surgeries; data analysis and performing surgeries; article review and intellectual concept of the article.

REFERENCES

1. Wagner AL, Florian K, Yan T, Clarke PJ. The impact of weather on summer and winter exercise behaviors. 2021;8(1):39-45.
2. Vosoughi AR, Trnka HJ. Peroneal Tendons Rupture in a Closed Talar Body Fracture: A Rare Injury. The Journal of Foot and Ankle Surgery. 2020;59(3):625-8.
3. Fujihashi A, Jones J. Association of Low-Dose Whole-Body Computed Tomography with Missed Injury Diagnoses and Radiation Exposure in Patients with Blunt Multiple Trauma. Journal of Emergency Medicine. 2020;59(1):163-4.
4. Cowley PM, Roberts CR, Baker AJ. Monitoring the Health Status of Mice with Bleomycin-induced Lung Injury by Using Body Condition Scoring. Comparative medicine. 2019;69(2):95-102.
5. Seo Y, Whang K, Pyen J, Choi J, Kim J, Oh J. Missed Skeletal Trauma Detected by Whole Body Bone Scan in Patients with Traumatic Brain Injury. Journal of Korean Neurosurgical Society. 2020;63(5):649-56.
6. O'Connor BM, Mba J, Gaspari AA. Cold burn injury after treatment at whole-body cryotherapy facility. JAAD Case Reports. 2019;5(1):29-30.
7. Wiese C, Keil D, Rasmussen AS, Olesen R. Injury in yoga asana practice: Assessment of the risks. Journal of Bodywork and Movement Therapies. 2019;23(3):479-88.
8. Huang P, Gu J, Wu J, Geng L, Hong Y, Wang S et al. [Corrigendum] Microarray analysis of the molecular mechanisms associated with age and body mass index in human meniscal injury. Molecular medicine reports. 2019;20(4):3968.
9. Emery C, Palacios-Derflingher L, Black AM, Eliason P, Krolikowski M, Spencer N et al. Does disallowing body checking in non-elite 13- to 14-year-old ice hockey leagues reduce rates of injury and concussion? A cohort study in two Canadian provinces. British Journal of Sports Medicine. 2019;54(7):414-20.
10. Schieren M, Böhmer AB, Lefering R, Paffrath T, Wappler F, Defosse J et al. Impact of body mass index on outcomes after thoracic trauma—A matched-triplet analysis of the TraumaRegister DGU - ScienceDirect. Injury. 2019;50(1):96-100.