MEDICAL PROMOTION EFFECT OF PHYSICAL EXERCISE ON PARKINSON'S DISEASE

O EFEITO MÉDICO DO EXERCÍCIO FÍSICO NA DOENÇA DE PARKINSON

EL EFECTO MÉDICO DEL EJERCICIO FÍSICO EN LA ENFERMEDAD DE PARKINSON

ORIGINAL ARTICLE
ARTIGO ORIGINAL
ARTÍCULO ORIGINAL

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ABSTRACT

Introduction: Parkinson's disease is a common neurodegenerative disease in middle-aged and older people. Some studies have shown that sports can reduce its impact on physical functions. Objective: Based on the abovementioned research background, this paper explores the effect of moderate physical exercise on muscle tone and body posture of patients with Parkinson's disease. Methods: The article selected 72 Parkinson patients admitted to our hospital's Parkinson's Medical Center from 2019 to 2020. These were divided into a basic drug treatment group and a sports intervention group. The Ashworth score, walking speed, walking cycle, and walking distance of the two groups were recorded. At the same time, we performed statistical data analysis on the two sets of data obtained. Results: Compared with the basic treatment group, the modified Ashworth score of the sports intervention group decreased after treatment (P<0.01). The walking speed of the sports intervention group increased, the walking cycle was shortened, and the distance of repeated steps increased (P<0.01). Conclusion: Appropriate physical exercise can reduce muscle tone in patients with Parkinson's disease. It helps them increase their pace and improve small gait symptoms. Sports can help Parkinson patients adjust their body posture and promote their clinical treatment. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Parkinson's Disease; Exercise Therapy; Muscle Tonus; Gaits.

RESUMO

Introdução: A doença de Parkinson é uma doença neurodegenerativa comum em pessoas de meia idade ou idade avançada. Alguns estudos mostram que o esporte pode reduzir seu impacto nas funções físicas das pessoas. Objetivo: Com base em pesquisas sobre o contexto mencionado acima, este estudo explora o efeito de exercício físico moderado no tônus muscular e postura corporal de pacientes com a doença de Parkinson. Métodos: O artigo selecionou 72 pacientes com Parkinson, internados no Centro Médico de Parkinson em nosso hospital, de 2019 a 2020. Estes foram divididos em dois grupos: um de tratamento medicamentoso básico e outro de intervenção esportiva. O escore Ashworth, velocidade de caminhada, ciclo de caminhada e distância de caminhada dos dois grupos foram registrados. Ao mesmo tempo, fizemos uma análise estatística de dados no conjunto de dados obtidos nos dois grupos. Resultados: Ao compararmos o grupo de intervenção esportiva com o de tratamento básico, o escore Ashworth modificado do primeiro grupo diminuiu após o tratamento (P<0.01). A velocidade de caminhada do grupo de intervenção esportiva aumentou, o ciclo de caminhada foi reduzido e a distância de passos repetidos aumentou (P<0.01). Conclusão: Exercícios físicos adequados podem diminuir o tônus muscular em pacientes com a doença de Parkinson. Auxilia no aumento de passos e melhora os sintomas dos passos curtos. Os esportes podem ajudar os pacientes ajustar sua postura e promover seu tratamento clínico. ***Nível de evidência II; Estudos terapêuticos – investigação de resultados de tratamento.***

Descriptores: *Doença de Parkinson; Terapia por Exercício; Tono Muscular; Marcha.*

RESUMEN

Introducción: La enfermedad de Parkinson es una enfermedad neurodegenerativa común en personas de mediana edad o edad avanzada. Algunos estudios muestran que el deporte puede reducir su impacto en las funciones físicas de las personas. Objetivo: Con base en investigaciones sobre el contexto mencionado antes, este estudio explora el efecto de ejercicio físico moderado en el tono muscular y postura corporal de pacientes con la enfermedad de Parkinson. Métodos: El artículo seleccionó 72 pacientes con Parkinson, internados en el Centro Médico de Parkinson en nuestro hospital, de 2019 a 2020. Se los dividió en dos grupos: uno de tratamiento medicamentoso básico y otro de intervención deportiva. Se registró la escala Ashworth, velocidad de caminata, ciclo básico de caminata y distancia de caminata de los dos grupos. Al mismo tiempo, hicimos un análisis estadístico de datos en el conjunto de datos obtenidos en los dos grupos. Resultados: Al comparar el grupo de intervención deportiva con el de tratamiento básico, la escala Ashworth modificada del primer grupo disminuyó tras el tratamiento (P<0.01). La velocidad de caminata del grupo de intervención deportiva aumentó, el ciclo de caminata se redujo y la distancia de pasos repetidos disminuyó (P<0.01). Conclusión: Ejercicios físicos adecuados pueden disminuir el tono muscular en pacientes con la enfermedad de Parkinson. Auxilia en el aumento de pasos y mejora los síntomas de los pasos cortos. Los deportes pueden ayudar a los pacientes a ajustar su postura y promover su tratamiento clínico. ***Nivel de evidencia II; Estudios terapéuticos – investigación de resultados de tratamiento.***

Descriptores: *Enfermedad de Parkinson; Terapia por Ejercicio; Tono Muscular; Marcha.*

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DOI: http://dx.doi.org/10.1590/1517-8692202127072021_0353 Article received on 07/29/2021 accepted on 08/18/2021

INTRODUCTION

Parkinson's disease (PD) is clinically manifested as resting tremor, bradykinesia, muscle rigidity, abnormal posture, and gait. Patients generally adopt a posture of leaning forward and flexing elbows, waist, and knees. The patient's stride is small when walking, showing a small fragmented gait. The walking speed is slow, and the walking pace is moderately reduced. The stride is getting smaller and smaller during walking, and the walking speed is accelerated, showing a gait that almost runs (panic gait). The patient wants to stop when it is severe and sometimes even hits an object. In addition, when starting a step and walking in a narrow place, they are often afraid to step (freezing gait). Rehabilitation therapy as an auxiliary method can play a certain role in improving symptoms while medication.[1] This study aims to explore the effect of exercise therapy on muscle tone and gait in PD patients.

METHOD

General information

This article selects 72 PD patients admitted to our hospital's PD diagnosis and treatment center from 2019 to 2020. These patients all met the diagnostic criteria established by the Dyskinesia and PD Group of the Neurology Branch of the Chinese Medical Association in 2006. Selection criteria: (1) Age<80 years old. (2) Patients did not adjust their medications from 1 week before enrollment to the start of the trial. (3) During the treatment, the patient did not take medicine or remained unchanged. Exclusion criteria: (1) Those who adjusted anti-PD drugs during treatment. (2) Those with serious complications such as long-term bed rest, severe infections, and fractures. (3) Those whose cognitive function declines and cannot cooperate with treatment.

Method

Grouping

We divided the 72 patients into groups according to the order of their visits. The singular is the sports intervention group, and the plural is the basic treatment group. There were 36 patients in each group.[2] There was no statistically significant difference in the general information of the two groups of patients (P>0.05), and the patients' data were comparable. (Table 1) Both groups were treated with basic drugs such as dopasrazide and pramipexole, and the sports intervention group was treated with exercise therapy.

Exercise therapy

(1) Maintenance of joint range of motion: We ask patients to engage in active or passive joint activities and try to complete active and passive joint activities as much as possible. (2) Traction activities of limbs and trunk muscles. The limbs are mainly traction flexors. (3) Slap therapy to relieve muscle tension: the rehabilitation practitioner's palm is perpendicular to the direction of the patient's muscle fibers, and the rehabilitation practitioner slaps with an open palm. We can choose to slap alternately with both hands, with a slap frequency of 4 to 6 Hz. (4) Audiovisual external stimulation: Do a large swing of both upper limbs for more than 10s before starting. (5) Cooperate with soothing background music in joint range of motion maintenance training, muscle traction training, and muscle slap training. (6) There are two classes a day, and the duration of each class is 40 minutes.

Table 1. Comparison of general information of the two groups of patients.

Grouping		Observation group	Control group	Total
n		36	36	72
Age		57.72±7.85	58.83±6.16	-
gender	male	20	18	38
	Female	16	18	34
Hoehn-Yahr staging	Phase II	10	8	18
	Phase III	18	16	34
	Phase IV	8	12	20

Data measurement heel binding marking method

We fix two water-based markers behind the heel to adjust the markers to be positioned accurately when the heel is in contact with the ground. The experiment obtains the following data: (1) Walking speed is the distance walked per unit time. The unit is expressed in m/s. (2) The walking cycle (stride time) is the time that elapses when one heel touches the ground during walking until the heel touches the ground again. The unit is expressed in s. (3) Repeat step distance (stride length) is the longitudinal straight-line distance between the front and back of the heel on the same side for two consecutive landings. The unit is expressed in m.

The human abnormal gait detection algorithm

We can use the $LMedS$ method to recover the background image from the image sequence.[3] Assuming that I represents a sequence containing N frames of images, the background image B_{xy} can be expressed as

$$B_{xy} = \min med_t (I_{xy}^t - q)^2 \quad (1)$$

q is the undetermined gray value at the pixel (x, y). Pixels can be obtained by the difference between the current frame and the background frame. In this paper, the adaptive threshold method can effectively remove the noise in the image.[4] The classification adopts the following Bayesian rule:

$$if P(b \mid vt, s) > P(f \mid vt, s), shens \in b \quad (2)$$

Pixel A is judged by the probability that it belongs to the foreground and background when the pixel's color value S is vt at the time t.[5]

due to:

$$P(b \mid vt, s) = \frac{P(vt \mid b, s)P(b \mid s)}{P(vt \mid s)} \quad (3)$$

$$P(f \mid vt, s) = \frac{P(vt \mid f, s)P(f \mid s)}{P(vt \mid s)} \quad (4)$$

Available:

$$P(b \mid s)P(vt \mid b, s) > 2P(vt \mid s) \quad (5)$$

$P(vt \mid b, s)\varsigma < P(b \mid s)\varsigma < P(vt \mid s)$ is obtained through statistics.

Statistical methods

The experiment adopts the t-test, rank-sum test, and the exact probability method of the four-grid table.

RESULTS

There was no significant difference in the modified Ashworth score between the two groups before treatment (P>0.05). After treatment, the modified Ashworth score of the sports intervention group was lower than that of the basic treatment group (P<0.05). (Table 2) There was no significant difference in walking speed, walking cycle, and walking distance between the two groups before treatment (P>0.05). The repetitive step distance was longer than that of the basic treatment group (P<0.01). (Table 3)

Table 2. Comparison of modified Ashworth scores before and after treatment in the two groups (n).

Grouping	n	Modified Ashworth score before treatment			Modified Ashworth score after treatment		
		I	II	III	I	II	III
Observation group	36	12	10	14	16	16	4
Control group	36	6	12	18	8	12	16
total	72	18	22	32	24	28	20
uc	-	0.95			2.07		
P	-	>0.05			<0.05		

Table 3. Comparison of changes in walking speed, walking cycle, and repeated step distance before and after treatment in the two groups (n=18).

Grouping	Walking speed/(m/s)	Walking cycle/s	Repeat step distance/m=
before therapy			
Observation group	0.54±0.11	1.60±0.22	0.68±0.15
Control group	0.56±0.10	1.58±0.17	0.70±0.17
t	0.57	0.31	0.37
P	>0.05	>0.05	>0.05
After treatment			
Observation group	0.14±0.09	-0.24±0.13	0.15±0.11
Control group	0.02±0.07	-0.05±0.07	0.00±0.06
t	4.47	5.46	5.08
P	<0.01	<0.01	<0.01

DISCUSSION

PD is a common neurodegenerative disease in middle-aged and older adults. With the aging of the Chinese population, the incidence of PD is increasing. The basic treatment of PD is drug therapy, but this method cannot be completely cured. As the disease progresses, the dosage of PD patients is gradually increasing, which is expensive, and the efficacy is getting worse. Patients in the advanced stage of the disease eventually become bedridden due to severe muscle rigidity and body stiffness. Patients generally die of complications.[6] The main purpose of rehabilitation is to minimize the use of drugs. Patients with drug treatment can prolong independent lifetime, reduce complications and delay the course of the disease.

Increased muscle tone leads to reduced joint range of motion and flexibility in PD patients. This is an important cause of movement disorders. Therefore, reducing the muscle tone of PD patients is an important goal of exercise therapy. Dystonia in PD patients may be caused by abnormalities in the motor inhibitory cortical system and weakened afferent motor sensory complex system. Correct relaxation training for PD patients can reshape the motor cortex system and strengthen the function of the sensory-motor system.[7] Some scholars used a parallel cross design to study the short-term therapeutic effect of whole-body vibration therapy on the motor function of 40 patients with PD. The results showed that stiffness and tremor were significantly improved. The patient's step length increases, and the nail groove speed increases. Some scholars have used whole-body vibration therapy with a frequency of 5-7Hz and an amplitude of 3mm on 63 patients with PD. The whole body vibration therapy consists of 5 sequences in total, each sequence lasts 1 min, and there is a 1 min rest between the sequences.[8] The results showed that the patient's tremor and stiffness were significantly improved. In this study, the percussion of the muscle was transformed into vibration to relieve the muscle tension. The local tapping reduces the whole-body vibration and brings tension and discomfort to the patient in the early stage of treatment.

Abnormal gait seriously affects the patient's daily life and may also cause trauma or even endanger life. This is another problem that needs to be solved in rehabilitation. It is worth noting that cues such as visual and auditory stimuli during walking training can improve walking. Some scholars have studied the short-term effects of different rhythmic external cues (auditory cues, visual cues, somatosensory cues) on the turn motion (180° turn speed) of PD patients. The results suggest that all three types can speed up the turning speed. The results suggest that both visually and externally can significantly improve the gait of PD patients.[9] The combination of audio-visual has no significant effect on improving the stride frequency or stride length. The improvement of its pace is similar to that of listening to prompts alone. In this study, the patients used visual stimulation before overcoming the difficulty of starting and freezing problems. After starting, give auditory stimulation to solve short gait, rapid gait, and falling. The results showed that the walking cycle time of the patients in the sports intervention group was shortened, the walking speed increased, and the repetitive step distance increased. This was significantly different from the basic treatment group (P<0.01).

PD patients should also set up handrails and non-slip rubber table mats in the room and bathroom in their daily lives. In this study, the muscle tone and walking gait of PD patients were improved to a certain extent compared with the basic treatment group through 3 months of exercise rehabilitation treatment.[10] During the treatment, some non-motor symptoms such as anxiety, insomnia, and constipation also changed. These require further exploration and research.

CONCLUSION

PD is a chronic progressive degenerative disease. There is currently no cure. The disease itself is not life-threatening, and complications such as pneumonia and fractures are common causes of death. Rehabilitation treatment can reduce the probability of complications. Therefore, the rehabilitation of PD patients' needs to be given full attention. The patient's treatment needs to be adhered to for a long time and throughout the entire course of the patient.

ACKNOWLEDGMENT

The study was supported by the grant Clinical Research Fund Project (QMSI2021L-07) of the Research Institute of medicine and Pharmacy Qiqihar. The study was supported by the grant Scientific Research Project of Health Commission of Heilongjiang Province (202115020446).

All authors declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. Hui Liu: Data curation, Writing- Original draft preparation, Validation; Chang Sun: Conceptualization, Methodology; Fengjiao Zhang: Project administration, Data curation; Tengteng Zhang: Methodology, Data curation;Hongxu Zou: Software, Data curation;Yunna Song: Supervision, Validation; Methodology, Writing- Reviewing and Editing.

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