Effect of Robotic training on walking and balance in patient with Hereditary Spastic Paraplegia

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ABSTRACT

Our patient was 22 years old and was being followed with pure Hereditary Spastic Paraplegia. He was provided with robot assisted-gait training combined with physiotherapy. Robot-assisted gait training lasted 40 minutes per a day and 20 sessions training. enforced about 7 weeks and three times in a week. Strenghten, stretching and balance exercise were applied as physiotherapy every day. He was evealuated in terms of functional ambulation category, Medical Research Council (MRC) Scale for muscle strength, Modified Ashworth Scale (MAS), 6-minute walking test, 10-meter walking test, timed up and go, Berg Balance Scale before and after treatment.After the treatments, the patient could walk more confidently and speedy. Robotic training can contribute to physiotherapy as plus to improve patient walking and balance

Key words: Hereditary spastic paraplegia, robotic training, walking, balance

INTRODUCTION

Hereditary spastic paraplegias (HSPs) are clinically and genetically heterogeneous group of neurodegenerative disorder characterised by insidiously progressive muscle weakness and spasticity of the lower extremities, which may be accompanied by additional neurological or non-neurological symptoms (1). The common pathological finding of HSPs is mutations in genes coding for proteins included in the maintenance of corticospinal tract neurons and this causes retrograde degeneration of the longest nerve fibres in the lateral corticospinal tracts, fibers of Goll and spinocerebellar tracts. The diagnostic clinical findings are of lower limb spasticity and weakness, increased deep tendon reflexia and babinski sign (2). The genetics of HSP are described as autosomal dominant, autosomal recessive, and X-linked recessive. The strong genetic heterogeneity is expressed by 52 different gene loci. The prevalence of all SPGs varies between 4.3 and 9.8/100,000. The differential diagnosis of progressive spastic paraplegia strongly relies on the age at onset, as well as the accompanying clinical properties, possible abnormalities on MRI, and family history. Moleculer testing is essential to confirm diagnose of HSP (3).

HSP is classified as pure if neurologic symptoms are limited to the lower limbs. Complicated forms of HSP exhibit additional neurologic and MRI abnormalities such as more significant peripheral neuropathy, ataxia, seizures, cognitive impairment, extrapyramidal disturbance, mental retardation, or a thin corpus callosum (4). At present, no treatment prevents or reverses nerve degeneration in patients with HSP. Treatment is depended on improving strenght and balance through physical therapy and rehabilitation.

Aim of this case is to show the result of robot-assisted gait training combined with rehabilitation treatment in a patient with HSP.

CASE REPORT

Our patient was 22 years old and had two brothers. They were being followed with pure HSP diagnose like our patient and do not work in any job. They had graduated from high school. Our patient did not suffer any surgery. He did not take any medication. The patient could walk independently and did not use orthose up to now but he could not climb stairs. He had crouch gait. The patient was not regularly rehabilitated. He had full (passive) range of motion at all joints. According to the Medical Research Council (MRC) scale, his hip flexor strength was 2, knee strength was 3, ankle dorsi-/plantar-flexor strength was 3. Spasticity scores of hip, knee and ankle were 2 bilaterally in both directions according to the Modified Ashworth Scale (MAS). Ankle clonus was grade 3 according to Tardieu Scale on both sides.

Intensive rehabilitation treatment was adjusted for the patient. Strengthen, stretching and balance exercises, 45 sessions, were applied for gait disturbance. Robot assisted-gait training was combined with physiotherapy. Robot-assisted gait training lasted 40 minutes per a day and 20 sessions training enforced about 7 weeks and the patient was admitted to the robotic training three times in a week. The gait robot provided a normal gait pattern on a treadmill by controlling movements of joints on lower extremities. The amount of body weight support was gradually decreased during the training.

Clinical and functional assessments were performed before and after treatment. Clinical and functional assessments included Functional ambulation category, MRC scale for muscle strength, MAS, 6-minute walk test (6MWT), 10-meter walk test, timed up and go (TUG), and Berg Balance Scale (BBS). Muscle strength of the lower extremities and spasticity did not change after treatment. 6MWT increased from 328 m to 350 m. 10-meter walk test decreased from 26 sn to 20 sn, and TUG

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decreased from 17 sn to 10 sn. BBS increased from 42 to 49. Functional ambulation category was same according to pre-treatment.

DISCUSSION

Our patient improved with physiotherapy and robotic training in terms of the functional assessments. The patient could walk more confidently and speedy. Robotic training can contribute to physiotherapy as plus to improve patient walking and balance and to increase patient'strength to reduce spasticity.

Robotic training can enforce along with physiotherapy for rehabilitation at several neurological disorders. Robotic training in patients wtih stroke increased walking endurance, walking speed but it could not achieve regain of patients' walking ability independently. The studies could not obtain any significantly recovery when robotic training applied less than three times per week (5).

Robot-assisted gait training can be advised for improving gait function in patients with different neurologic disorders. There is increasing proof that high-intensity, repetitive, task-specific training such as treadmill training might result in better gait rehabilitation and it causes augmentation in neuroplasticity of the spinal and supraspinal control steps of walking. Robotic gait training is feasible in gait rehabilitation of chronic spinal cord injury and stroke patients. It can cause improvements in muscle strength, walking ability, balance and quality of walk (6,7).

Han Gil Seo et al presented a patient with HSP who suffered robotic training 25 sessions. They performed gait analysis as a different measure from our assessment. They obtained improvement in gait speed and balance except of gait biomechanics (8).

Bertolucci et al admitted to the study thirteen adult patients affected by uncomplicated HSP to show effectiveness of a robotic-aided program of gait training on balance, walking ability and quality of life. They found that a robotic gait training had effect over two months in improving balance and walking ability with a favorable effect on quality of life in HSP patients (9).

Straudi et al showed walking endurance and spatio-temporal gait parameters improvements after robot-assisted gait training in Multiple Sclerosis patients. Pelvic anteversion and decreased hip extension during terminal stance were improved after robot-assisted gait training. Adjustment of the kinematic of the hip and pelvis could be provided via this treatment (10). Eva et al showed that robot assisted treadmill walking disclosed decrease in trunk and pelvis movement amplitude in healthy individuals.

Lokomat is currently being used in patients who have gait disturbance due to several neurological disorders. There are different findings about robotic training in the literature. It is suggested that proof on the effectiveness of locomotor therapy is limited and it is not clear whether healing is greater compared with other gait rehabilitation methods (11-16). Randomized controlled trials with larger, specific populations are needed to show effectiveness of robotic gait training in the different disorders such as HSP.

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