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Update on rehabilitation in multiple sclerosis

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Summary

Given that mobility impairment is a hallmark of multiple sclerosis, people with this disease are likely to benefit from rehabilitation therapy throughout the course of their illness. The review provides an update on rehabilitation focused on balance and walking impairment. Classical rehabilitation focusing on muscle rehabilitation, neurotherapeutic facilitation is effective and recommended. Other techniques did not prove their superiority: transcutaneal neurostimulation, repetitive magnetic stimulation, electromagnetic therapy, whole body vibration and robot-assisted gait rehabilitation and need more studies to conclude. Cooling therapy, hydrotherapy, orthoses and textured insoles could represent a complementary service to other techniques in specific conditions. Multidisciplinary rehabilitation program provides positive effects and high satisfaction for patients with multiple sclerosis but needs more evaluation. New technologies using serious game and telerehabilitation seem to be an interesting technique to promote physical activity, self-management and quality of life. Rehabilitation like other therapy needs regular clinical evaluation to adapt the program and propose appropriate techniques. Moreover, the objective of rehabilitation needs to be decided with the patient with realistic expectation.

Multiple sclerosis (MS) is a chronic progressive disease of the central nervous system (CNS) that can affect a wide range of functions, including muscle strength, coordination, sensation, vision and cognition, inducing balance and mobility limitations [1]. Physical therapy (PT) provides interventions to maintain or improve balance, mobility, build exercises and activity tolerance, respiratory function and reduce impact of spasticity. Interventions are often focused on educating patients and family members [2].

Rehabilitation is part of the therapy of MS since its description in 1870 by J.M. Charcot [3]. In the 1950s, publications on this theme were common and mostly advised around the use of physical agents such as cold baths, electrotherapy, but also the practice of passive and active mobilization and physical exercise... [4–7]. Physical activity has been proposed for many years [8]. The first randomized controlled trial (RCT) was published in 1996 by Petajan et al. [9]. It concluded that physical activity induced no risk and that exercise training was effective in this pathology. After the 1990s, the emergence of new technologies: robotics, neuromodulation and more recently telerehabilitation (TR) provide alternative arrangements for implementing rehabilitation. The

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effectiveness of rehabilitation has been widely studied but usually the level of evidence is low to moderate and presents poor methodology [10,11]. We can also notice that there are often many biases in randomization, low inhomogeneous samples, no double blind and lack of description of interventions [10,11]. The assessment of effects is also difficult to prove although some validated scales are available to analyse the effectiveness of the rehabilitation programs.

We propose through a literature review to update and study more specifically what is new in the rehabilitative approach of balance and mobility impairment in patient with MS (PwMS).

What kinds of rehabilitation techniques are effective in MS?

Neurotherapeutics approaches

PT includes wide range of techniques and conceptual treatment methods that are not yet studied with rigorous scientific methods but, nevertheless, may be of value. Bobath concept, proprioceptive neuromuscular facilitation, Vojta reflex locomotion have already been used since the 1950s [12]. Their theoretical approaches were based on the motor control and are called facilitation approaches. A new model of motor control is the systems model [13] which forms the basis for the task-oriented therapeutic approach focusing on specific disabilities of an individual patient. These methods have in common the aim of improving activities of daily living (ADL) by applying internal and external stimuli to achieve better movement. In the task-oriented approach a patient learns by repeating a given specific task in different environments and under different conditions. The ability to carry out a specific task may be more important than the quality of the execution and leads to improve ADL [14,15].

Some authors evaluated the effect on balance of these approaches in PwMS and revealed a significant effect on the time one-leg stance test when outpatient physiotherapy and home exercises based on an individualized problem-solving approach were compared with no treatment [16,17]. Lord et al. [18] and Wiles et al. [19] have compared a facilitation approach with functional exercise and they both reported statistically unchanged performance on balance tested by Berg balance test (BBS) and timed one-leg stance test following the facilitation approach when compared with functional exercise. Bronson et al. [20] found that hippotherapy had a positive effect on balance in PwMS but this finding was based on only 3 non-RCT studies. Kanekar et al. [21] more recently proposed to use a light finger touch contact with a stationary surface to improve upright postural stability. Results showed that this technique was effective in reducing postural sway in both the sagittal and frontal planes, in all experimental conditions. Authors concluded that light finger touch contact is effective in enhance postural control in PwMS moderately disabled and can be considered as a useful rehabilitative strategy and an aid to stability [21].

These findings indicate small, but significant effects of neurorehabilitation approaches in PwMS who have mild to moderate level of disability. However, evidence for severely disabled people is lacking, and further research is needed.

Exercise training

Exercise training has been proposed to counteract many symptoms of MS and their consequences on ADL [22–24]. Two types of exercises are proposed alone or combined: aerobic exercise training and resistance training programs.

Aerobic training program

The goal of aerobic training is to improve physical capacity and the indicators are represented by maximal oxygen uptake (VO_2max) and power output (mechanical power generated during exercise). Patients are asked to perform some exercises on different support like step, leg and arm cycling ergometers, walking, treadmill, aquatic exercises. . . Training programs must be realized at a minimum frequency of 2 to 3 times per week for 30 to 60 minutes at moderate intensities (60–80% maximum work rate or 60% VO_2max). These programs are effective in improving aerobic capacity and power output in MS [25].

Resistance training program

Their target is to increase muscular strength impact mobility, balance and performance of ADL [25]. Resistance training program use various types of machines (weight machines, free weights, resistance bands, locomotor training, cycling, and aquatics training). Resistance training is generally performed at an intensity of 10 to 12 repetitions maximum, 2 to 3 times per week during 8 to 20 weeks. Strong evidence suggests that

Glossary

ADL	activity of daily living
AFO	ankle-foot orthoses
BBS	Berg balance test
BWS	body weight support
CNS	central nervous system
EDSS	expanded disability status scale
FES	functional electrical stimulation
MS	multiple sclerosis
NO	nitric oxide
PT	physical therapy
PwMS	patient with multiple sclerosis
QOL	quality of life
RAGT	robot-assisted gait training
RCT	randomized controlled trial
TENS	transcutaneous electrical nerve stimulation
TR	telerehabilitation
TT	treadmill training
VO_2max	maximal oxygen uptake
VR	virtual reality
WBV	whole body vibration