Multiple sclerosis: physical activity and well-being

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Abstract
Multiple sclerosis (MS) is a chronic disease that affects central nervous system (CNS) – coexists in brain, spinal cord and optic nerves. It can process in three different courses: remitting, progressive and progressive-relapsing. Although there is still no cure for MS, effective strategies are available to modify the disease course, reduce number of relapses, rate of progressions and development of new lesions. Nowadays, moderate physical performance is strongly recommended: besides having positive effects on the body, it can have a positive effect on the psychophysical wellbeing. Essentially there are 3 types of training protocols: aerobic (endurance training), strength training (resistance training) and combined training. The majority of the studies suggests that regular physical activity can improve fatigue, depression and quality of life in people with MS, however most of the researchers worked without any guidelines for physical activity adapted to the MS, which are still under review by the scientific community.

KEYWORDS: central nervous system, myelin loss.

Introduction
Multiple sclerosis (MS) is a chronic disease that affects central nervous system (CNS) which coexists in brain, spinal cord and optic nerves. In particular, nerve fibers are surrounded by a fatty substance, myelin, which helps them in the conduction of electrical impulses. The disease causes loss of myelin in different areas, leaving the formation of sclerotic tissue or lesions that determine the denomination as plaques sclerosis. The nerve fibers can also be damaged or broken by stopping the ability to conduct electrical impulses to the brain, inducing symptoms that are common in MS [38]. These should cause permanent disability that many people with MS experience and should follow one of four disease courses, each of which may be mild, moderate or severe.

Relapsing-Remitting MS
People with this type of worsening of neurological function called relapses attacks, have periods followed by stages of partial or complete recovery (remissions), during which there is no progression of the disease occurs. About 85% of these people have an initial diagnosis of relapsing-remitting MS.

Primary-Progressive MS
This disease course is characterized by a slow worsening of neurological function from the beginning, with no distinct relapses or remissions. The rate of progression may change over time, with occasional short and temporary improvements. About 10% of people are diagnosed with primary-progressive MS.
**Secondary-Progressive MS**
After an initial period of relapsing-remitting MS, many people have a course of secondary progressive disease in which there is a steady decline, with or without occasional flare-ups, and minor recoveries (remissions). About 50% of people with relapsing-remitting MS, developed this form of the disease within 10 years of onset, although now there are drugs that seems to disease-modifying significantly the delay of this transition.

**Progressive-Relapsing MS (PRMS)**
In this type of course of the disease (5%) people experience a continuously worsening, especially in neurological function. May experience some stages of recovery after these effects, but the disease continues to progress without remissions. Because no two people have the same experience of MS, the disease course may look different from person to person [4].

So far it is unknown the exact cause of MS; most researchers believe that the damage to myelin comes out from an abnormal immune system response. This abnormal response is called autoimmune response. Generally, the immune system results an ally that responds to external pathogens attacks. The situation is different when it attacks its own tissue (as occurs in MS), and autoimmune response that culminates in the destruction of myelin. It is not yet clear what triggers this process; probably a multifactorial process which plays an important role genetics, gender and environmental factors (for example, a virus or an environmental toxic substance) [12]. MS is not a contagious disease, it does not seem to be inherited even if a genetic predisposition may be involved. Anyone can develop MS, in particular:
- Most patients receive a diagnosis between 20 and 50 years.
- It appears to be a larger impact on women than men.
- Scientific research shows that there is a genetic predisposition for the disease onset.
- There are many people coming from north of europe even you can find a lot of African-Americans, Hispanics and Asians people.

Is estimated that around 2.5 million people around the world are affected by MS: about 28 people a day receive a new diagnosis. Until now there is no biological marker that can be used to diagnose the disease and need an additional tests including:
- **Patient history**, in order to detect the symptoms suggestive of a CNS damage;
- **Neurological examination**, to evaluate reflexes, coordination, balance and vision.

**MS symptoms**
In multiple sclerosis, damage to the myelin as well as nerve fibers produce an interference with nerve transmission between brain, spinal cord and other parts of the body. This interruption causes primary symptoms of MS depending on where the damage occurred. In the disease courses, some symptoms are reversible, while others may be more permanent. The most common symptoms are:
- **Fatigue**: is one of the most common symptoms of MS, occurring in more than 80% of people. Fatigue can significantly interfere with a person’s ability to perform its functions at home and at work. It is commonly described as a sensation of “exhaustion” of the energies, with a worsening during the day that is not related to the level of effort.
- **Numbness**: it is one of the most common symptoms of MS. It is intended as the numbness of the face, body, or extremities (arms and legs) and is often the first symptom experienced by patients.
- **Walking (Gait), Balance, & Coordination Problems**: among the most common mobility limitations in MS there is the difficulty to walk and it is linked to several factors: weakness (muscle weakness is a major gait difficulty; it can often be compensated by performed an appropriate exercises that can help the patient); spasticity (is one of the most common symptoms of MS and can also interfere with the gait. It refers to feelings of stiffness and a wide range of muscle involuntary spasms (sustained muscle contractions or sudden movements). Spasticity can simply feel the muscles or can be so severe as to produce tension pain, or uncontrollable spasms of the extremities: stretching exercises and antispasmodic drugs may alleviate the reported symptoms); loss of Balance (balance problems usually result in gait called “drunken” known as ataxia).
- **Vision Problems**: a vision problem is the first symptom of MS for many people. The sudden onset of double vision, blurring, poor contrast or eye pain can be terrifying and the knowledge that vision may be compromised can make people with MS anxious about the future.
- **Pain**: pain syndromes are common in MS. In one study, 55% of people with MS had “clinically significant pain” at some time. Almost half were troubled by chronic pain. Pain in MS can result from damage to nerves in the CNS (neurogenic pain), or result from altered gait patterns or inappropriate use of assistive devices (orthopedic pain).
- **Cognitive Function**: cognition refers to a range of high-level brain functions, including the ability to...
learn and remember information: organize, plan, and problem-solve; focus, maintain, and shift attention as necessary; understand and use language; accurately perceive the environment, and perform calculations. Cognitive changes are common in people with MS – approximately 50% of people with MS will develop problems with cognition.

- Emotional Changes: emotional changes are more common in MS than in other chronic illnesses – because of neurologic and immune changes caused by the disease, and as a reaction to the stresses of living with a chronic, unpredictable illness. Bouts of severe depression (which is different from the healthy grieving that needs to occur in the face of losses and changes caused by MS), mood swings, irritability, and episodes of uncontrollable laughing and crying (called pseudobulbar affect) pose significant challenges for people with MS and their family members [6, 18, 30].

**MS management and physical exercise**

Although there is still no cure for MS, effective strategies are available to modify the disease course, reduce number of relapses, rate of progressions and development of new lesions through the use of FDA-approved, disease-modifying drugs; to treat acute attacks, also known as relapses or exacerbations, to shorten the duration and reduce the severity; to manage symptoms; to improve function and safety; to provide emotional support, in combination, these strategies enhance the quality of life for people living with MS. Until a few years ago, doctors believed that people with MS required all their strength to face our daily activities. Sport and movement were considered overstrain and therefore were not recommended. Today, however, the opinion has changed and it deals with the discussion in a more different way. Moderate physical performance is strongly recommended: furthermore, besides having positive effects on the body, it can have a positive effect on the psychophysical wellbeing [24]. In particular it has been demonstrated that patients with MS with EDSS <6 have reported minor muscle strain, improved ability in performing exercises, as well as in a daily routine [15, 27, 34]. It was also suggested that exercise may also have anti-inflammatory effects potentially slowing the progressive course of the disease [17, 21]. Basically, inactivity worsens the state of health of patients with MS [9]. Scientific research has shown a strong interest in this area. The results in many cases have shown the beneficial effects of appropriately structured and adapted exercise protocols on MS patients. Essentially there are 3 types of training protocols: aerobic (endurance training), strength training (resistance training) and combined training. However most of the researchers worked without any guidelines for physical activity adapted to the MS, which are still under review by the scientific community and is still suffering from a certain approximation. For this reason the results of many studies are not comparable each other because of substantial differences relating to the sample (number of patients, type of MS and EDSS level), type and duration of the protocol, timing of sessions, type and intensity of training [2, 29, 31].

**Training protocol**

Beyond the limits mentioned above, it has been possible to evaluate the results obtained depending on the type of workout protocol.

**Endurance training (ET)**

Endurance training (ET) is the most studied type of exercise. The sessions are performed by cycle ergometer or arm ergometer, treadmill, or through water exercises. Aerobic protocols are characterized by positive cardiorespiratory and neuromuscular changes; however, it would seem that ET has no effect on functional capacity (speed in going up/down stairs, walking speed etc.) [9]. Endurance training gave few results in activities that might otherwise depend on muscle strength. Also, it is not clear whether this type of training has effects on fatigue. In this regard, the studies are inconsistent and the rating scales used are not so sensitive to lack of a common standard [8]. It seems that this training is positively correlated to quality of life, mood and decrease in depressive symptoms. Recent data suggests the potential role of the innate immune system in the initiation and progression of MS, and also indicates that aerobic exercise may modulate the innate immune system by directly targeting Toll-Like Receptors signaling events [32]. There is also inconsistency between the degree of EDSS and achievements.

**Resistance training (RT)**

Resistance training which is focused mainly on the muscles of the lower end, being the worst hit by the disease, appears well tolerated at low-to-moderate intensity in MS patients with mild-to-moderate disability. Notable improvements (3-29%) were however found in upper extremity muscle strength (elbow extensors, elbow flexors, shoulder abductors and shoulder adductors) in studies exercising these muscle groups, indicating possible clinical meaningful strength improvements in
that has recently been developed, and therefore there is after 6 months of follow up. This training is a protocol that this protocol works on fatigue, in some cases even and to be administered every other day. Studies show proportions between resistance and endurance training.

It is based on the assumption that there must be equal certainty is an improvement in muscle strength after resistance training [1, 13, 40]. Another important aspect is newly emerged and indicates that the resistance training can slow down the progression of the disease by acting on cytokines in blood [19, 39]. This is in line with the latest scientific findings which identify the skeletal muscles as a secretory tissue able to produce and release cytokines in a contraction-dependent manner [5, 26]. Although it may think that higher intensity exercise can have an effect on inflammatory processes, so far none of these studies report significant increments but others do not. Differences also exist on the effects of progressive resistance training compared with depressive symptoms and quality of life (lack of common and/or appropriate methodologies). One certain is an improvement in muscle strength after resistance training [1, 13, 40]. 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some stairs of MFIS. This suggests that people with MS participating in regular physical activity have favorable scores in fatigue, depression and quality of life, when compared to people with MS who do not participate in regular physical activity. This study gives strength to earlier proposals that regular physical activity can improve fatigue, depression and quality of life in people with MS. In addition, it highlights the need for direct intervention studies not only to people with mild to moderate disabilities, but also to those patients with moderate to severe disabilities, in order to understand the potential improvements in physical activity to improve the quality of life of all people with MS. Therefore, further research, studying the best exercise method that can provide the maximum benefit to people with MS with varying degrees of disease severity, should be supported and encouraged.

References


