

Literature review / Revue de la littérature

Effort training in Parkinson's disease: A systematic review

Réentrainement à l'effort et maladie de Parkinson : revue de la littérature

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Abstract

Objective. – Physical therapy strategies have recently proved their efficacy in the field of Parkinson's disease management. The purpose of this paper was to access the efficacy and the limits of aerobic training and strength training included in physical rehabilitation programs and to define practical modalities.

Method. – A comprehensive search on Pubmed and Cochrane databases was made.

Results. – Five literature reviews and thirty one randomised trials have been selected. Exercise training improves aerobic capacities, muscle strength, walking, posture and balance parameters. Rehabilitation programs should begin as soon as possible, last several weeks and be repeated. They should include aerobic training on bicycle or treadmill and a muscle strengthening program.

Conclusion. – There is evidence that aerobic and strength training improve physical abilities of patients suffering from Parkinson's Disease. Rehabilitation programs should be discussed with the patient, taking in account his difficulties and his physical capacities. Two questions are debatable: exercise intensity and phase ON / phase OFF timing.

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Keywords: Parkinson's disease; Exercise therapy; Exercise training; Physical therapy; Strength training

Résumé

Objectifs. – La maladie de Parkinson idiopathique est progressivement invalidante et incomplètement contrôlée par les thérapeutiques médicamenteuses. La prise en charge non médicamenteuse conjointe s'est parallèlement étoffée avec de nouvelles approches intéressantes parmi lesquelles le réentrainement à l'effort. L'objectif de ce travail est, à partir des données de la littérature, de préciser les preuves scientifiques de l'intérêt et des limites du réentrainement à l'effort et d'en déterminer les modalités pratiques.

Matériel et méthode. – Une revue de la littérature a été faite à partir des moteurs de recherche Pubmed et Cochrane.

Résultats. – Cinq revues de la littérature et 31 essais randomisés ont été inclus. Le réentrainement à l'effort améliore les capacités aérobies d'adaptation à l'effort, la force musculaire, le schéma de marche, la posture, l'équilibre et la qualité de vie de ces patients. Il doit être débuté le plus tôt possible, prolongé, répété dans le temps et doit associer un travail sur cycloergomètre ou tapis de marche à un renforcement musculaire global.

Conclusion. – Le réentrainement à l'effort apporte des bénéfices certains chez les patients parkinsoniens, le protocole doit être individualisé en fonction des doléances et des capacités du patient. Deux questions sont encore débattues : l'intensité d'exercice et l'horaire à privilégier.

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Mots clés : Maladie de Parkinson ; Traitement par les exercices physiques ; Renforcement des capacités ; Exercice physique ; Entraînement en résistance

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1. English version

1.1. Introduction

Idiopathic Parkinson's disease (PD) is a degenerative disorder of the central nervous system with an unknown etiology. It should be differentiated from Parkinson syndromes, which can be induced by infections, drugs, environmental toxins as well as vascular disorders or tumors and Parkinson-plus syndromes (group of neurodegenerative diseases including multiple system atrophy, progressive supranuclear palsy, corticobasal degeneration and Dementia with Lewy bodies). PD is the most common neurodegenerative affection second only to Alzheimer's disease. In spite of advances in drug therapeutics, PD often leads to impairments and severe disabilities. PD is the second leading cause of neurological impairments (ischemic stroke being the first one).

With the aging of the population and subsequent increase in PD patients, care management of this disorder is becoming a public health challenge.

Rehabilitation care of patients with PD has improved in the past years, especially for motor and language impairments. Rehabilitation techniques must be adapted to the disease's stage. Based on experiences in animal models, strength training has become a large part of rehabilitation care programs for patients with PD. Several recent randomized, controlled studies have highlighted its benefits. However, because of the heterogeneity in exercise parameters and patients' demographics, it is difficult for PM&R teams to implement it in daily practice.

The objectives of this study, in light of literature data were first to determine the relevance of strength training in PD and second to refine practical modalities for clinical applications.

1.2. Parkinson's disease: evaluation scales [14,48]

Several tools for the clinical evaluation of patients with PD have been validated and are used in clinical settings:

- global evaluation scales, such as the Hoehn and Yahr scale [35], reliable but not very sensitive to change, it allows the classification of patients into 5 stages according to the disease' progression;
- analytical evaluation scales, to appreciate the intensity of each clinical symptom (Webster Scale for example);
- functional scales measuring the impact of PD on daily life activities (PDQ-39 [62]);
- multidimensional scales to better assess the real situation of patients; the most commonly used scale is the Unified Parkinson's Disease Rating Scale (UPDRS) [19]. Its section III (motor examination), at the first stages of the disease, can help monitor its progression and adapt the treatment. It is also a helpful diagnostic tool since a score improvement > 50%, 3 to 5 years after having implemented Dopamine replacement therapy, points towards a diagnosis of idiopathic PD [2];
- generic scales exploring more specifically cognitive and psychological functions as well as motor fluctuations.

The progression of PD consists in three stages: the "honeymoon" stage (1 to 8 years) during which drugs are quite effective in managing the disorders; the second stage, in average 4 to 5 years after the onset of the disease, when motor complications related to Dopamine replacement therapy (DRT) start to appear (end-of-dose akinesia, ON-OFF phenomena, dyskinesia at the middle of the dose, biphasic dyskinesia); the third stage, labeled "advanced" or "decline" stage, during which DRT is no longer effective and axial motor symptoms (posture and balance disorders, falls, dysarthria/dysphagia), cognitive/behavioral disorders and autonomic dysfunction (Dysautonomia) become predominant.

1.3. Conventional rehabilitation techniques used in patients with Parkinson's disease

Several PM&R techniques have proven their efficacy and are used in clinical settings for the care management of patients with PD. The choice of these techniques must be guided by the disease stage.

1.3.1. Stretching and muscle resistance training

Muscle resistance training for quadriceps, hamstrings and foot extensors improves bradykinesia, muscle stiffness as well as gait and balance parameters [18,34]. In idiopathic PD, there is an imbalance between agonist muscles that facilitate opening movements (e.g. extensors, supinator muscles, external rotators, scapula and pelvic abductors) and antagonist muscles that facilitate closing movements (flexors, pronators, internal rotators and adductors), as evidenced by the difficulties encountered for quick, alternative movement in pronation-supination or flexion-extension [28]. Physical therapy programs must include passive stretching of antagonist muscles and strengthening of agonist muscles [28]. Some exercises for active mobilization in axial rotation should be implemented to fight stiffness, which affects the trunk. Tai Chi exercises can also help reduce balance disorders [42].

1.3.2. Attentional strategies

1.3.2.1. Cognitive strategies. It has been validated that focalizing the attention of PD patients on a task actually improves its performance [54]. Verbal instructions or "cognitive cueing" were the first strategies studied: for example, asking patients to focus on performing ample steps [50], or swinging their arms exaggeratedly when walking to fight bradykinesia. It is important to recommend to patients to plan and mentally visualize the movement beforehand, concentrate on the movements while performing it and break down a complex task into simple sub sequences. Dual-task conditions deteriorate motor performances in PD patients [6], and it is recommended to learn to eliminate dual-task situations at an advanced stage of the disease. However, Brauer and Morris as well as Canning et al. reported that dual-task training in mild and moderate stages of PD associated with verbal instructions to help patients focus on their gait, reversed motor deterioration and improved gait parameters [5,10].

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