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SHORT COMMUNICATION/COMMUNICATION BRÈVE

Physical activity limits the effects of age and Alzheimer's disease on postural control

L'activité physique limite les effets de l'âge et de la maladie d'Alzheimer sur le contrôle postural

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Summary The aim was to study the possible influence of physical activity on the postural performance of subjects with Alzheimer's disease (AD). The postural performance (i.e. surface area of the center of foot pressure displacement) of 3 groups was compared: Alzheimer active group (AA), Alzheimer non-active group (ANA) and healthy non-active group (HNA). The AA group's postural performance was superior to that of the ANA and HNA groups. AD disturbed postural performance but participation in regular physical activity made it possible to limit the disturbing effects of AD to a surprising extent, since the postural performance of active AD subjects was also superior to that of healthy subjects.

MOTS CLÉS
Activité physique ;
Contrôle postural ;
Maladie d'Alzheimer ;

Résumé L'objectif était d'étudier la possible influence l'activité physique sur la performance posturale de sujets atteints de la maladie d'Alzheimer (MA). La performance posturale (i.e. surface de déplacement du centre de pression des pieds) de 3 groupes de sujets a été analysée: Alzheimer actif (AA), Alzheimer non actif (ANA) et sains non actif (HNA). La performance posturale du groupe AA était supérieure à celle des groupes ANA et HNA. Bien que la MA perturbe la performance posturale, l'activité physique régulière a permis de limiter les effets

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Performance posturale ;
Personnes âgées

perturbateurs de la MA de manière surprenante puisque la performance posturale des sujets AA était également meilleure que celle des sujets HNA.

Introduction

Aging alters sensory and motor functions, which induces postural disturbances [18]. Moreover, in the case of healthy older subjects, cortical contribution has an increasing role in postural regulation, thus leading to less automatized postural control in comparison with healthy young subjects [2]. This increased cortical contribution probably disadvantages older subjects who suffer from conditions that impair cognitive function, such as Alzheimer's disease (AD). Cerebral lesions generated by this disease cause functional disturbances to the motor cortex [8], thus aggravating postural disturbance in comparison with healthy older subjects [5,15,16]. This aggravation of the postural disturbance of older subjects with AD increases the risk of falling, which can affect their autonomy [1,15].

It is known that prevention measures to reduce the risk of falls, such as physical activity programs, can reduce the aging effects in healthy subjects [7]. Physical activity increases cardiac output, which augments cerebral blood flow; this in turn increases angiogenesis, neurogenesis, synaptogenesis and neurotransmitter synthesis and thus facilitates brain plasticity and the cognitive function of healthy subjects [10]. Furthermore, physical activity improves sensory and motor function as well as central integration of the postural system [7].

Through non-instrumented clinical tests, numerous studies have shown that physical activity improves the postural function of AD subjects [3,6,13]; on the other hand, some other studies did not observe such improvement [14,17]. However, few previous studies have used instrumented tests with force platforms in order to objectively characterize the postural behaviour in AD subjects [11]. In a recent study, based on force platform evaluation, De Andrade et al. [4] identified an improvement of postural behavior in individuals affected by AD who undertook physical exercise combined with cognitive tasks. However, in the case of AD subjects who undertake physical exercise only (without combined cognitive tasks), this improvement of postural behavior with the use of a force platform remains to be confirmed. If validated, the postural improvement of AD subjects related to the practice of physical activity alone would enable them to totally or partially compensate for the postural disturbance associated with the disease. The aims of this study were:

- to confirm the improvement of postural behavior of AD patients as a result of regular physical activity (comparing active AD subjects with non-active AD subjects);
- to study the possible influence of regular physical activity when comparing active AD subjects with healthy non-active subjects of the same age.

We hypothesized firstly that active AD subjects would have better postural behavior than non-active AD subjects and, secondly, that they would have similar postural behavior to that of non-active healthy subjects.

Materials and methods

A total of 56 voluntary subjects living in a nursing home participated in the study. Forty subjects were diagnosed as having had AD for at least 18 months, by means of neuropsychological tests, physical examinations, blood tests and magnetic resonance imaging of the brain. Among these AD patients, 20 subjects (14 women, 6 men) had undertaken regular physical activity (5 sessions of 1 hour, 5 days per week conducted by caregivers and assiduously followed by subjects) for at least 3 years, which combined endurance activities (speed walking), resistance (elastic band and bodyweight based exercises) and balance training (proprioception exercises). They constituted the active Alzheimer's group (AA). The other 20 AD patients were non-active (15 women, 5 men) and constituted the non-active Alzheimer's group (ANA). The last 16 subjects were cognitively healthy and non-active (10 women, 6 men) and constituted the healthy non-active group (HNA). The division of subjects into three groups was based on the unit organization of the nursing home: one unit included only active Alzheimer subjects, one unit included only non-active Alzheimer subjects and one unit included only non-active healthy subjects. For a given state of AD evolution, the admission of AD patients into one of the two units was carried out in an arbitrary way according to their order of arrival in the nursing home. Only one unit proposed physical activity whereas the other service did not. Exclusion criteria included a documented balance control disorder, a medical condition that might affect balance control, hip, knee or ankle trauma in the previous 2 years, any lesion of the foot skin support surface and medical treatments including beta blockers or neuroleptics. Subjects' age, body mass index (BMI) and the results of the Mini Mental States Examination (MMSE) are presented in Table 1 for the three groups. The groups were of similar age and BMI, whilst there were obviously differences in MMSE between AD and healthy subjects. On the other hand, AD active and non-active subjects were similar in terms of MMSE score. This experimental procedure received the approval of the local committee for the protection of human subjects.

A platform force (Stabilotest® Techno Concept, Cereste, France; Sample frequency: 40 Hz) was used to calculate the center of foot pressure (COP) displacement. Subjects were asked to remain as still as possible for 25.6 s, while keeping their arms alongside their body and fixing a target positioned in front of them. The COP surface area (90% confidence ellipse mm^2) and the mean COP velocity (sum of the cumulated COP displacement divided by the total time) along the mediolateral (COPX) and anteroposterior (COPY) axes